Chemical Age

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VOL. 82 No. 2094

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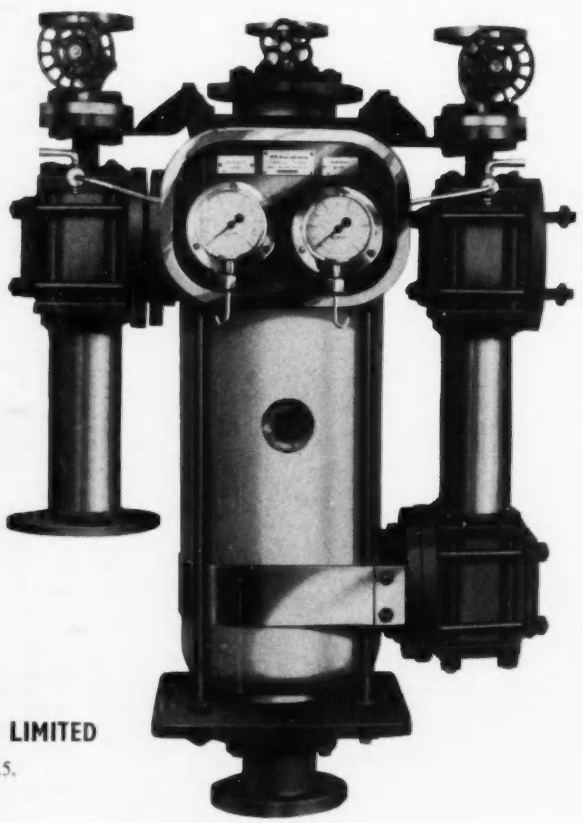

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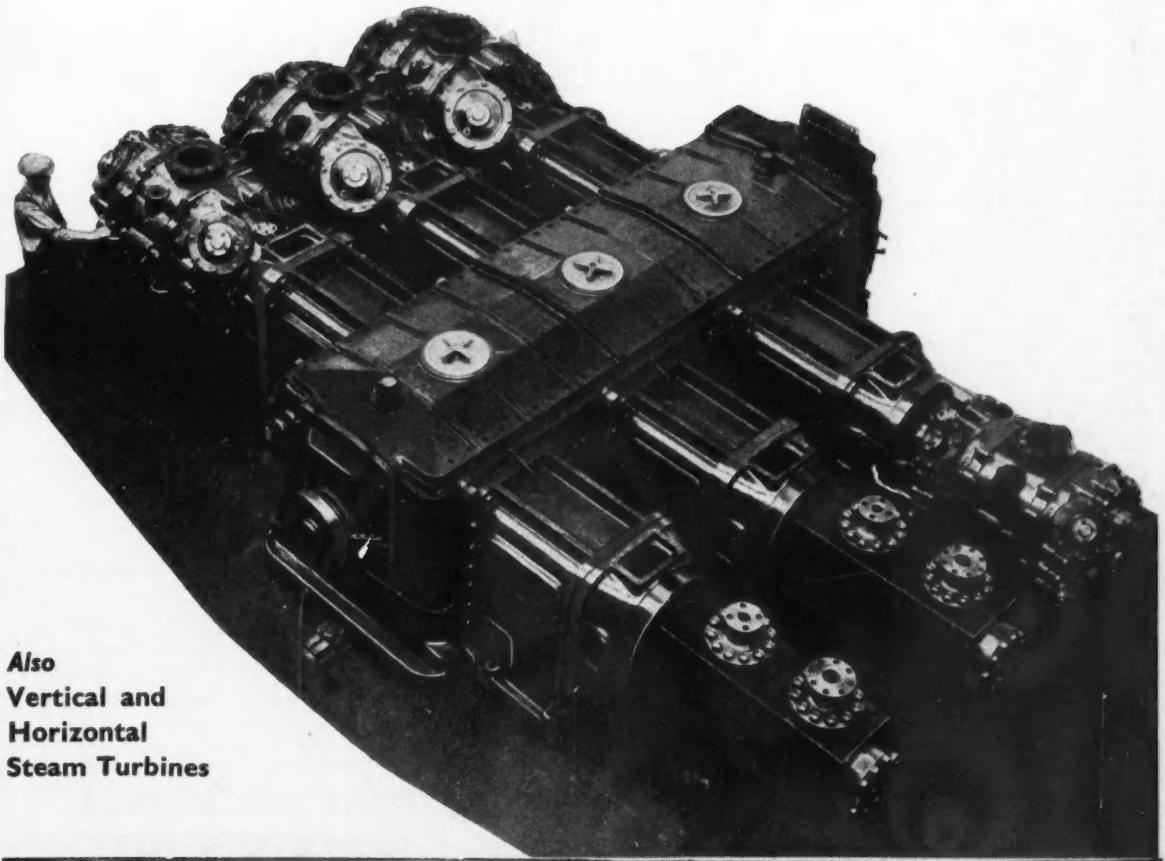

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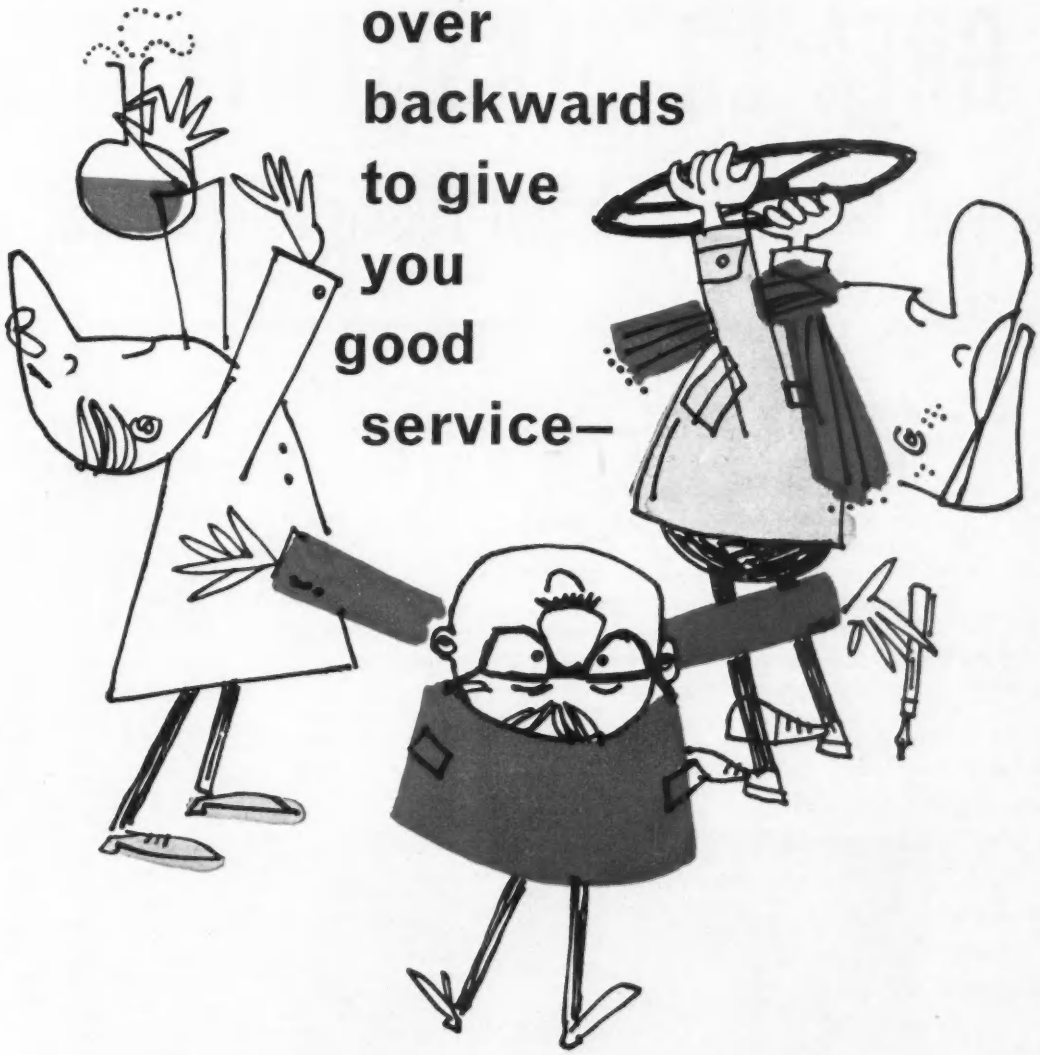

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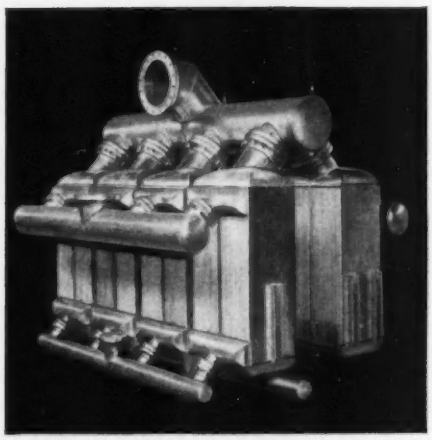

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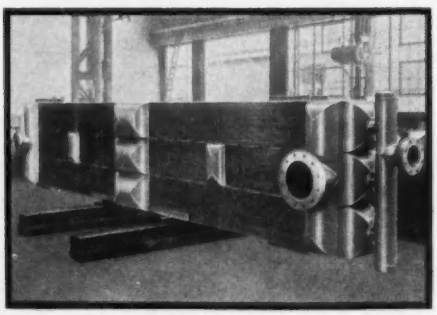

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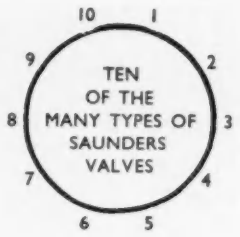

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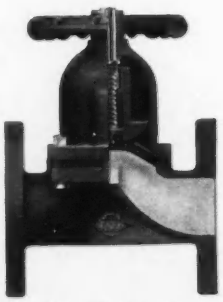

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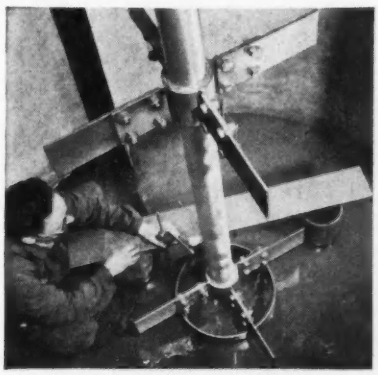

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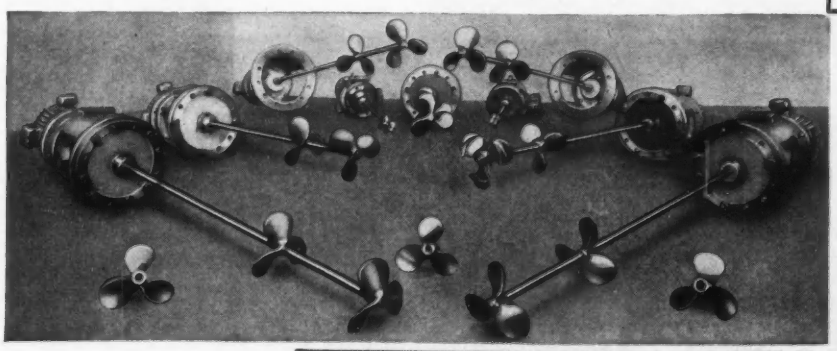

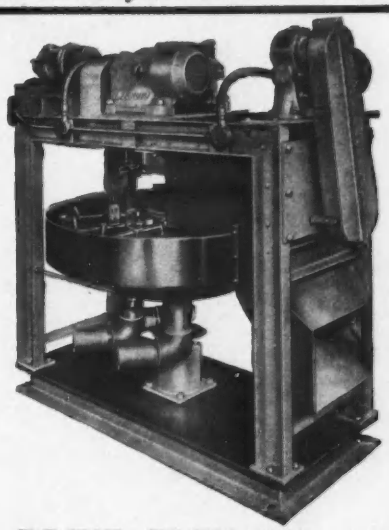

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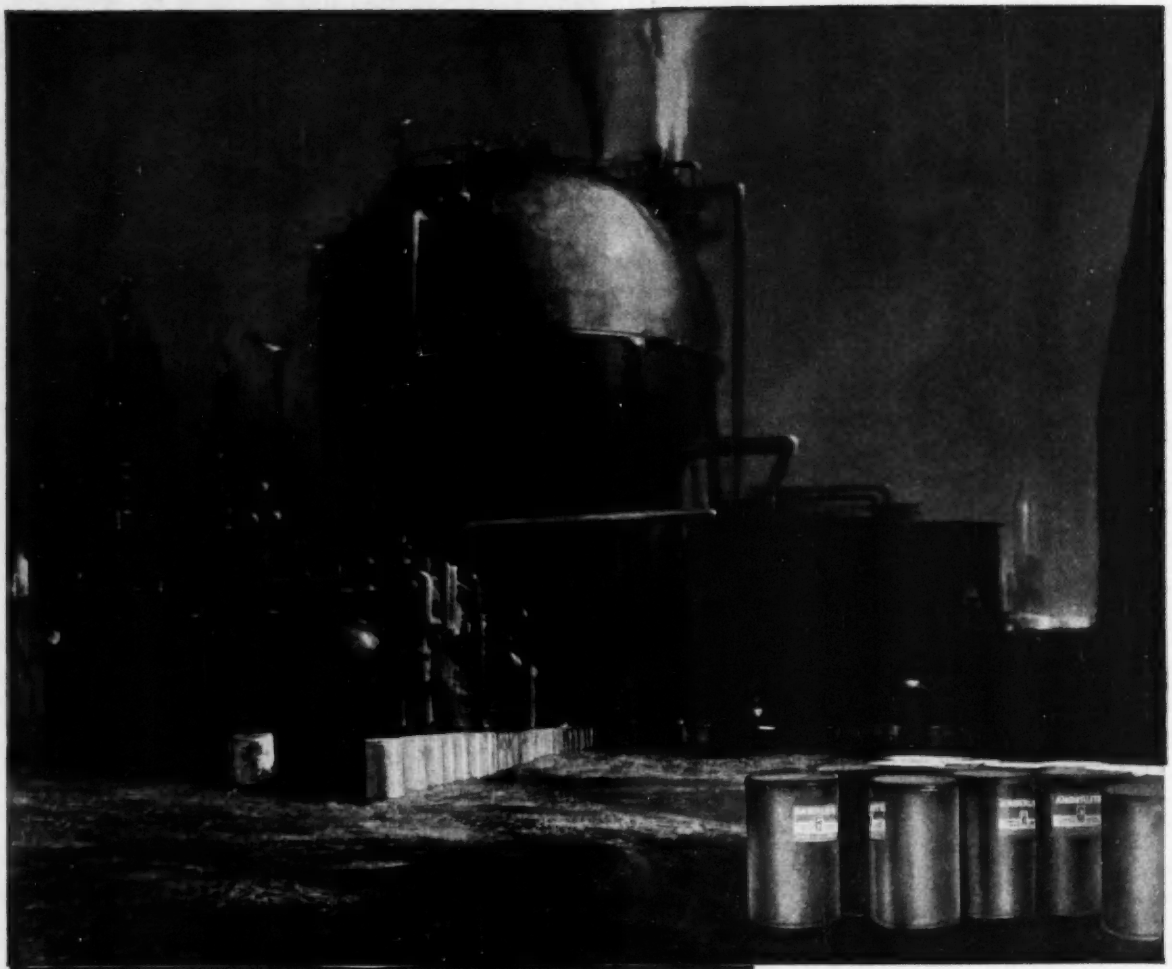

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CHEMICAL AGE

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HIGHEST-EVER EXPORTS

THE British Chemical industry has recovered from the setbacks of 1958, brought about by the recession in world-wide industry, and 1959 should be a record year so far as sales are concerned. Already exports are running at a record level and for the first seven months of 1959 totalled £166,797,313, a monthly average of £23.8 million. This is the highest-ever figure and, if maintained, the year's total will be more than £18 million up on the previous record year of 1957, when the total was £267.4 million. Last year chemical exports were valued at £263.1 million.

The seven-months' total for all chemicals, which as listed in the Trade and Navigational Accounts includes pharmaceutical goods such as bandages and dressings and essential oils. was £166,797,313, compared with £151,086,556, an increase of £15,610,757. Imports of chemicals during January to July were worth £75,641,191, against £70,870,764, an increase of £4,770,427. Britain's credit balance on her import-export trade in the first nine months of this year, therefore, was £91,156,122 compared with £80,215,792 in the same period of 1958.

There can be little doubt that the current recovery in chemical exports is due to the better economic conditions now prevailing throughout the world. This is obvious from the U.K. exports of sodium hydroxide, which last year were at a low level, due to restricted Indian imports. For the first seven months of this year, U.K. shipments of caustic soda were valued at £3,434,831, an increase of £1,36 millions over the same period of 1958.

Other chemicals, exports of which have risen greatly this year include: hydrosulphite, the seven-months' figure being £496,806, an increase of £225,865; magnesium compounds, £364,238 higher at £844,783; organic acids, anhydrides, their salts and esters, £578,864 higher at £1,522,274; ethyl alcohol, methyl alcohol, methylated spirits and alcohols, a rise of £281,137 to £1,195,718; organic sodium compounds, up by £139,500 to £332,284; organic dyestuffs intermediates, up by £295,818 to £869,591; mineral tar and chemicals from coal, petroleum and natural gas, up by £560,569 at £2,240,665.

The recovery also extended to synthetic organic dyestuffs, etc., which has suffered more severely than most other sectors of the U.K. chemical industry. No doubt the better results here are due partly to the newer ranges of dyestuffs that have been introduced. The January to July 1958 figure was £6,494,354, an increase of £1,235,567; countries which increased their imports of U.K. dyestuffs were Hong Kong, Australia, Canada, Finland, Sweden, Netherlands, Belgium, France, Italy, Japan, and the Argentine. India and Pakistan took considerably less than in 1958.

The seven-months' figure for drugs, medicines and medicinal preparations, at £23,335,031, was up by £1,348,425. This was achieved despite decreases in some cases; for instance, exports of antibiotics, at £4,382,052, were lower by £645,604, and acetylsalicylic acid shipments, at £697,590, were down by £21,488. Increases were recorded for provitamins and vitamins, alkaloids, antihistaminics, antipaludics, liver extracts, and sulphonamides (prepared).

The decline of £1,312,798 to £1,514,781 in fertiliser shipments was due to a big drop in exports of ammonium sulphate. On the other hand exports of plastics materials were higher by £4,355,825 at £22,134,453. Despite

cheap imports, U.K. p.v.c. exports rose by £682,388 to a total of £4,158,005; polythene shipments, increased by £131,248 to £425,589; polystyrene exports were up by £266,118 to £1,611,375.

An increase of £1,352,728 was recorded for exports of tetra-ethyl lead anti-knock compound, which totalled £7,344,855.

So far as imports were concerned, notable advances were recorded for alcohols, which totalled £2,650,173 (£1,804,753); synthetic organic dyestuffs, etc., £2,213,482 (£1,511,578); p.v.c. £2,230,279 (£1,696,104). Declines were recorded for arsenic trioxide, aluminium oxide, calcium carbide, silicon, organic acids and anhydrides, antibiotics, and alkyd resins. Sulphur imports totalled £2,387,700 (£2,183,551).

It has been apparent for some time that the chemical industry had recovered the momentum that was lost last year. Annual statements of company chairmen have clearly shown that the industry has been getting back into its expansionist stride. Whether margins of profit will rise in proportion to sales remains to be seen, for it must be admitted that the success of Britain's chemical salesmen has been to some extent at the expense of selling prices.

Many companies have had to peg prices in view of the fierce competition, particularly from overseas. To meet what for some could be a period of 'profitless prosperity', the larger companies are tending to concentrate on diversification, while smaller firms are relying on rationalisation on a narrower range of products, on specialisation and an all-out drive to upgrade productive efficiency.

The view has been expressed that the current upswing in sales cannot last; that the European Common Market will in a year or two make nonsense of today's export performances. Despite the pessimists, it is interesting to note that a number of U.S. chemical companies are actively planning new plants in the U.K.—confident that stability in labour, economics and in the political field will prove an advantage compared with building in the C.M. area.

The following table shows U.K. exports of chemicals to the C.M. countries for the first seven months of 1959, compared with the same period of 1958, alongside similar figures of U.K. imports from those countries. It will be seen that the adverse balance in Britain's chemical trade with West Germany and France continues and more than offsets the favourable trading balance with the other countries of the C.M. area. The total adverse balance for January to June 1959 was £4.12 million, compared with £3.76 m.

U.K. TRADE WITH C.M. COUNTRIES

	U.K. Exports *January to July*		U.K. Imports *January to July*	
	1958	1959	1958	1959
	£m.	£m.	£m.	£m.
West Germany	5.77	5.88	12.59	13.29
Netherlands	5.72	6.95	4.64	5.39
Belgium	3.67	3.96	2.52	2.84
France	4.84	4.40	6.86	7.09
Italy	4.74	5.62	1.83	2.32
	24.74	26.81	28.44	31.20

BACON'S FUEL CELL

YET another British invention—F. T. Bacon's Hydrox (hydrogen-oxygen) fuel cell (see p. 213) appears likely to be commercialised by the U.S. and later sold back to the U.K. At the demonstration of the cell on Monday, it was announced that Patterson-Moos Division of Universal Winding Co., had a licence and know-how exchange agreement with National Research Development Corporation, who are sponsoring the cell. This U.S. company has already produced two streamlined versions of the Hydrox cell, based on patent information supplied by N.R.D.C. since agreement was reached with the U.S. company four to five months ago. At the same time Patterson-Moos have also given information to Bacon and his team of six.

Advisability of granting licences for the inventions has been carefully studied, and Mr. D. Hennessey, deputy managing director of N.R.D.C. indicates that N.R.D.C. has come to the conclusion that the U.K. would benefit. "More money is to be spent in the immediate future in the U.S. on fuel cells than is going to be spent in this country, but the benefits will flow back into the U.K." he reports. So far the invention has been under investigation for the last 27 years and has cost a total of £100,000, some £80,000 being spent in the last two years by N.R.D.C. in their present contract with Marshall of Cambridge. This contract expires this year. It is understood that the contract is to be renewed but no specific sum for the work still to be done has been decided so far. Marshall's, in fact, have six months to get the unit 'mobile'—that is, as a working unit on its own.

Details of fuel cells, and the Bacon cell in particular, are known to British industry, Government and the Services. The Electrical Research Association has been interested since at least 1946. The Admiralty has sponsored some of Bacon's work and British Transport Commission have considered the cell for storage of electricity. N.R.D.C. agree, however, that British industry has shown little interest until the last few weeks. General H. M. Liardet, Ministry of Supply, which looks after Development of the Army and Air Force, says the Ministry is interested but will not take up developments until they are in an "engineered condition."

Why has British industry shown so little interest. Is it lack of money or technical personnel or as Professor W. R. Hawthorne, Cambridge University, stated on Monday lack of "technological imagination"? The fuel cell, producing electricity directly in one stage can achieve efficiencies of about 80%—compared with the 35-40% efficiency using conventional methods. Applications of the fuel cell range from submarines to space vehicles, while rail traction is an attractive possibility. It is estimated that it costs £500,000 to electrify each mile of track but an electric locomotive equipped with a fuel cell fed from containers of oxygen and hydrogen could operate over long distances. No overhead wires or conductor rails would be required.

Undoubtedly U.S. interest in fuel cells is associated with their military and defence interests. Many U.S. companies, among them some well-known chemical companies, are working on fuel-cell systems which might eventually be used for power generation and which would range from large stations to portable units. Revolution of the U.S. transport system within the next five years is already predicted on the strength of present fuel cell development. On the military side, compactness and light weight of units, no detectable reaction products, no noise, reduction or complete elimination of moving parts and hence reduced maintenance problems, are all highly desirable factors.

Have the potentialities of fuel cells escaped British industry and the Services? At the present time it is hard to discover the answer. Money expended so far in the U.K. is very small compared with the estimated £2 million by the U.S. in the last year, yet the Bacon cell is nearest to commercial success. Estimated cost of electricity produced by the cell is put at 4d. a unit, based on present day costs of hydrogen and oxygen. Hydrogen is a definite stumbling block at present, although with tonnage oxygen plants available and tonnage hydrogen plants from British Oxygen Co. in the near future, the cost factor could become more realistic in so far as power outputs of more than 100 watts are concerned. Can we not see more interest from British industry in the Bacon fuel cell in the near future? If not, what is the reason for its lack?

N.R.D.C. Sponsored Hydrox Fuel Cell Enters Pre-commercial Stage

British Scientist's Pioneering Work

NOW approaching commercial realisation is F. Thomas Bacon's Hydrox (hydrogen-oxygen) fuel cell (CHEMICAL AGE, 1958, 80, 106, 755, 979). In Cambridge on Monday at the works of Marshall of Cambridge Electronics Ltd., the cell was demonstrated to a large audience including the technical press, Government and Services personnel. The cell has completed the second stage of its development and is capable of giving an output of 5 kW at 24 volts. The next stage is the production of a completely automatic and reliable 'battery' capable of producing power at a moment's notice in a practical installation. Cost to date of research is estimated at £100,000.

First envisaged in 1839 by Sir William Grove, development of a practical fuel cell has been the lifelong work of Mr. F. T. Bacon, now consultant for National Research Development Corporation at Marshalls. He began his work in 1932 and began full time work on the hydrogen-oxygen cell in 1940-41 for Dr. Charles Merz. Ten years of original research were carried out at Cambridge University from 1946 under the auspices of the Electrical Research Association and the Ministry of Power, before the National Research Development Corporation took up the idea and placed a development contract with Marshall's in 1957.

The fuel cell is an electro-chemical cell in which the free energy of combustion of a fuel is converted directly into electrical energy; the fuel in the Bacon cell is hydrogen and oxygen. The Hydrox cell operates by a simple reversal of the process of electrolysis of water and by direct production of electricity in one stage, can achieve efficiencies of about 80%—compared with the 20% efficiency of nuclear-produced electricity and several times better than conventional methods.

40-cell Unit

The largest cell evolved previously was one of six 5 in. cells in series. The one now produced consists of 40 cells 10 in. diameter, each cell unit being separated by three strips of p.t.f.e. attached to a separating annulus composed of the electrode metal. Output from the new cell is 2½ kW. at 32 volts (or 5 kW. at 24 volt max. load conditions). To accomplish this, a great many new technical problems have been solved, and automatic controls have been developed.

The Cell Unit. Each unit consists of two electrodes, one for hydrogen and the other for oxygen, separated by electrolyte, strong potassium hydroxide. The electrodes are made of porous sintered nickel with a thin layer of a smaller pore size on the liquid side. The oxygen electrode is treated with lithium and pre-oxidised to prevent corrosion. Working conditions are around 200°C and 400 p.s.i. The electrolyte soaks into the sintered metal but, on the application of the gas under pressure from the back of the plate, is expelled from the large pores; the gas cannot bubble through the smaller-pored surface owing to the surface tension of the liquid. There is thus a very large surface of wetted sintered metal in contact with gas in each electrode—about 40 square metres.

Production of Electricity. Oxygen molecules on the positive electrode combine with water to form negatively charged hydroxyl ions which each remove an electron from the oxygen electrode. Hydroxyl ions migrate through the electrolyte to the negative electrode where they combine with the hydrogen to form water, depositing an electron in the process. The hydrogen electrode thus becomes negatively charged with respect to the oxygen electrode and a current flows in the external circuit. In order to remove the water formed, the hydrogen is circulated past the back of the hydrogen

F. T. Bacon, inventor of the fuel cell, talks to H. Avis at the control panel for the fuel cells

BRITISH AND U.S. FUEL CELLS COMPARED

Type	Fuel	Power	Company	Remarks
Hydrogen-Oxygen cell				
Bacon Hydrox cell	Hydrogen & oxygen	5kW. at 24 volts	National Research Development Corp. project	Most advanced type available producing highest power outputs and current densities.
Patterson-Moos	" "	50-1000 amps./sq. ft. 1-0.6 volts	*Patterson-Moos Div. Universal Winding Co. U.S.	Have two streamlined Bacon Hydrox cells, working under N.R.D.C. licencing know-how arrangements (see p. 212).
	* Also interested: Electric Storage Battery Co., U.S., Allis-Chalmers Research Div., Chrysler Corp.'s Automotive Div., U.S. Army Signal Research & Development Laboratory.			
Molten-salt fuel cell	Carbonaceous fuels (CO_2, CH_4 natural gas, water gas, kerosene, etc.)	60 amps./sq. ft. 0.7 volts	Ministry of Power and Shell Research Ltd.	Electrolyte is fused alkali carbonates (Na_2/Li carbonates temperature 450°-800°C. a major disadvantage. Relative small power output. Advantage is use of carbon containing fuels.
	Carbonaceous gas & air	30-100 amps./sq. ft. 0.96-0.54 volts	Consolidation Coal Co. U.S.	
	" "	Lower power yields than Consolidation Coal Co.	General Electric Research Lab., U.S., and Curtiss Wright Corp., U.S.	
Redox fuel cell	Coal	20 amps./sq. ft. 0.5 volts	King's College, London University	Tin-Br intermediate.
	Impure hydrogen	40 amps./sq. ft. 0.8 volts	General Electric, U.S. Lockheed Aircraft Corp., U.S.	Tin-Br intermediate. Chemicals in form of liquid electrolyte provide current generating reaction at electrode surfaces. Impure fuels can be used.
Regenerative fuel cell	Lithium hydride	450 amps./sq. ft. 0.36 volts	Mine Safety Appliance Research Corp., U.S.	Lithium hydride reacts at 450°C in lithium fluoride-lithium chloride eutectic mixture. Feasible if cheap source of photochemical, radiochemical, electrolytic or thermal energy available. Regeneration occurs at 850°C.
Consumable-electrode cells	Sodium & oxygen	100 amps./sq. ft. 1.4 volts	National Carbon, U.S.	Uses consumable anode of alkali or alkali-earth metal and either solid cathodes of organic material with graphite or porous carbon cathodes through which organic liquid or oxygen is fed to cell. Low operating temperatures and high power-to-weight ratio.
	Zinc & chlorine	35 amps./sq. ft. 1.6 volts	†Aerojet-General Corp., U.S.	
	† Also interested: R.C.A. Laboratories, U.S., Armour Research Foundation, U.S., Dow Chemical Co., U.S.			
Ion-exchange cell	Hydrogen & oxygen	6-45 amps./sq. ft. 1-0.6 volts	General Electric, U.S.	Uses ion-exchange membrane (porous gel). Low operating temperature and pressure, no liquid electrolyte, good power-to-weight and power-to-volume features.

Based on information in "Chemical Age", "Chemical and Engineering News", and "Chemical Week".

MAIN DATA FOR THE HYDROX CELL

Power/unit vol. (considering cell int. vol. only)	10.7kW/cu. ft.	(M)
Power/unit weight (cell pack only)	9.2 watts/lb.	(M)
Wgt. of H. used/kW hour	0.112 lb.	(R)
Wgt. of O. used/kW hour	0.893 lb.	(R)
Vo. (at N.T.P.) H. used/kW hour	20 cu. ft.	(R)
Vol. (at N.T.P.) O. used/kW. hour	10 cu. ft.	(R)
Rate of condensate/kW hour	0.45 litre	(R)
Operating pressure	300-600 p.s.i.	
Operating temperature	200°C.	
Electrolyte concentration, KOH	40% (1.4 sp. grav.)	
Free energy efficiency	50%	(M)
	65%	(R)
Wgt. of gas storage (cryogenic)/kW hour	4 lb.	(R)
Wgt. of gas storage (cylinders)/kW hour	17.8 lb.	(R)
Energy/unit vol. (traction batteries 5-hour rate)	1.5kW hour/cu. ft.	
Energy/unit wgt. (traction batteries 5-hour rate)	11.5 watt hour/lb.	

Rated output assumed at 0.8 v. per cell designated (R).
Maximum output assumed at 0.6 v. per cell designated (M).

electrodes and the mixture of hydrogen and steam is cooled externally, and condensate is released as required.

Control system. Much work has been done on the control system during the last 18 months. To avoid damage to the cell the pressure of the two gases must be very evenly balanced. The system now evolved is to keep the oxygen pressure constant (dropped to 600 p.s.i. in first stage and then 400 p.s.i. in second stage) and to control the hydrogen pressure against it by a very accurate differential pressure meter activating a power-operated inlet valve controlled by a servo-mechanism. Gas pressure volume against the electrolyte has also had to be considered and a level sensing device eliminates gas. Unwanted gas is released to atmosphere. Other problems of initial heating and subsequent cooling have also had to be solved. Further work is being carried out on dissipating heat formed, and a recording panel records individual cell performances for check purpose.

As shown at the demonstration, the Hydrox fuel cell is composed of the 40 cell unit about 30 in. in length. The automatic control system stands some 5 ft. in height and would occupy with cylinders of hydrogen and oxygen and recording panels an area 6 ft. square. In this prototype weight and volume have not been minimised and in the main the control instruments and panels used are standard in the U.K. although in certain cases these have been modified.

Bacon's unit does not generate its own gases. Cylinders of hydrogen and oxygen (containing 150 cu. ft.) are used up at the rate of two cylinders of hydrogen to one of oxygen in about an hour. The only by-product material is water.

Aluminium for Sub-zero Methane

WHEN the Gas Council decided to experiment in importing liquid methane, aluminium alloys were chosen for the large welded storage vessels required. The Aluminium Development Association reveals that the project required much research work to confirm that aluminium alloys, both welded and unwelded, were suitable for this application.

Considerable quantities of aluminium were required at three stages: firstly, for the special storage tanks fitted into the converted ocean tanker, *Methane Pioneer*, which carries 2,000 tons of liquid methane; secondly, for the long lengths of piping to convey the cold liquid from the tanker to storage tanks ashore; finally, for the two large storage tanks at Canvey Island, Essex.

Storage Tanks. Material selected for the storage tanks was an aluminium alloy containing about 5% magnesium, which corresponds to alloy NP5/6 (B.S. 1477). These tanks, 50 ft. high by 50 ft. in diameter and principally made from plates about 16 ft. sq. were designed by the North Thames Gas Board in conjunction with the A.P.V. Co. Ltd., Crawley and Whessoe Ltd., Darlington (CHEMICAL AGE, 21 February, p. 351, and 14 March, p. 469).

The two tanks have bases about ¼ in. thick while the walls are ⅛ in. at the top. Fabrication was entirely by inert-gas metal-arc welding to the highest possible standard. The welding was inspected radiographically. The aluminium tank is surrounded by a 3 ft. layer of insulating material and an outer steel shell.

Pipework. The extensive pipework consisted mainly of 10 in. diameter seamless tube of alloy NV5 (B.S. 1471) supplied in 20 ft. lengths and welded by A.P.V. into 60 ft. lengths at their factory and finally welded on site to form 600 ft. lengths before flanged joints were applied; 2,000 ft. of piping was needed.

As contraction and expansion is a complicating factor over long lengths of pipe and at the low temperatures involved, articulators were installed to take up any movements and the pipe was laid on roller supports for free movement.

Insulation. Pipes were lagged with a 6 in. layer of Onazote, supplied by the Expanded Rubber Co., Croydon, firmly fixed and then covered with bituminous felt. The felt was then protected with aluminium paint.

Underneath the base of the aluminium tank was placed a 3 ft. 6 in. layer of diatomaceous earth bricks, and aluminium foil or Sisalkraft was inserted within this layer. The space between the walls and roofs of aluminium and steel tanks was filled with Brelite, an insulating granular material.

Glossary of Packaging Terms

Most recent addition to the British Standards Institution's series of published glossaries of terms is B.S.3130, 'Glossary of Packaging Terms.' This 105-page fully indexed edition contains many hundreds of definitions.

Ministry of Power's High Temperature Fuel Cell

IN ADDITION to the Bacon hydrogen-oxygen fuel cell which was the subject of the demonstration at Cambridge on Monday, work is proceeding on another type of fuel cell in the U.K.

The Ministry of Power, between 1951 and 1953, in collaboration with the Electrical Research Association, gave assistance towards the development of the hydrogen-oxygen fuel cell with which Mr. F. T. Bacon is identified at Cambridge. When the National Research Development Corporation assumed responsibility for the further development of this cell, however, the Ministry decided to utilise their resources towards the creation of a fuel cell which might employ a wide range of industrial fuel gases and distillate fuels which were not suitable for use in the type of cell that had been developed at Cambridge.

At the present time the development of such a cell is proceeding at the Sondes Place Research Institute in Dorking under the auspices of the Ministry of Power and Shell Research Ltd. A cell is in process of development using hydrocarbon vapour and air with a molten electrolyte supported in a sheet of porous magnesia for the generation of electricity (CHEMICAL AGE, 1958, **80**, 105). A paper on the work of this cell will be presented by Dr. H. H. Chambers and Mr. A. D. S. Tantram at a symposium on fuel cells to be held by the American Chemical Society at Atlantic City on 15 September 1959.

C.J.B. Men Hurt in Gasifier Explosion

THREE employees of Constructors John Brown Ltd. working on an experimental gasifier under contract for the Ministry of Power were slightly injured on Tuesday when a mishap led to a local fire at the Leatherhead station of the British Coal Utilisation Research Association. After treatment at hospital the men went home. The damage was not extensive.

A pipe burst in the gasifier and a jet of burning gas and coke broke through a window from the working bay to the central control room. The fire was fought by the staff and the local brigade; breathing apparatus was worn because of the carbon monoxide fumes.

In his annual report, Lord Aberconway, chairman of John Brown and Co. Ltd., referred to work at C.J.B.'s Leatherhead research and development section on the Ministry of Power's pressurised coal gasifier. This work, which has proceeded intensively, may, he said, make a major contribution to the economic use of coal.

Industrial Safety Campaign 1959

Owing to the recent dispute in the printing industry, the Industrial Safety Division of the Royal Society for the Prevention of Accidents has had to postpone the national safety campaign, planned for the week beginning 28 September, until the week beginning 23 November 1959.

New I.C.I. Dyes are Big Step in Nylon Dyeing

PROCINYL dyes, a new class of disperse dyes, have been introduced by I.C.I. Dyestuffs Division, Hexagon House, Blackley, Manchester. The new dyes bring the dyeing of nylon to the same level of development as that reached in the wool and cellulosic fibre dyeing fields. With them it will be possible to produce on nylon textiles standards of fastness and quality of coloration not previously obtainable.

The initial four Procinyl dyes (yellow, orange, scarlet and blue) display on nylon and other polyamide fibres the desirable attributes of the established disperse dyes —good levelling, good coverage of irregular-dyeing yarns, good compatibility in admixture, good temperature-range properties and good penetration. They are applied in a similar manner. The essential difference is that the Procinyl dyes are applied initially under slightly acid instead of neutral conditions, and that dyeing is completed by an alkaline fixation stage during which certain reactive groups in the Procinyl dye molecules react chemically and irreversibly with the amine or amide groups in the polyamide fibre and so produce high wet fastness.

Only slight or negligible reaction takes place between Procinyl dyes and acetate and triacetate rayons. With the exception of Procinyl Yellow G, the new dyes are of minor importance on Terylene and other polyester fibres. Only the yellow is of particular interest in the dyeing of Acrilan polyacrylonitrile fibre.

50th Nitrogen Plant for Incandescent Heat

WITH A recent order for two 5,000 c.f.h. nitrogen plants, the Gas Atmospheres Division of the Incandescent Heat Co. Ltd. Smethwick, has now installed or has on order 50 nitrogen plants with capacities ranging from 500 to 32,000 s.c.f.h. The majority of these plants are packaged units and can be transported in one piece.

These plants depend on the combustion of gaseous or liquid fuel with air so that atmospheric oxygen is converted to CO_2 and H_2O. The water is removed by cooling, refrigeration and desiccant drying, while scrubbing with monoethanolamine removes CO_2. Complete removal of H_2, CO_2 and O_2 is accomplished by a unique Incandescent process which depends upon the use of a special catalyst. Another feature of these generators is the high degree of flexibility, since the flow of amine, fuel gas and air are all related to the demand for nitrogen. The resultant nitrogen has a purity equivalent to that obtained by any other method.

Alchemy to Set Up Maleic Anhydride Plant

Chemical subsidiary of Burt, Boulton and Haywood Ltd., Alchemy Ltd., announce that they have placed a contract with Petrocarbon Developments Ltd. for the erection of a medium-sized plant to produce maleic anhydride. It is anticipated that production will commence during the third quarter of 1960.

LONDON TRANSPORT TO BUILD NEW CENTRAL LABORATORY

WORK has begun at Chiswick on a new two-storey building to house the central laboratory of London Transport's Research Department. It will enable the scientific staff for the first time to be under one roof instead of in scattered, cramped accommodation in various parts of the Chiswick Works estate.

Among facilities to be provided are a cold chamber for low-temperature testing, a specially-designed, screened room for work with a 200-kV industrial X-ray apparatus and for gamma-radiography using a cobalt 60 source, heat-treatment furnaces and welding equipment, a pilot plant laboratory, special recording equipment for strain gauge tests, and a fatigue testing machine for railway car axles.

London Transport's small but highly specialised research department undertakes special research of great value, and carries out regular routine investigations of stores and materials purchased by L.T. It is also responsible for the technical control of certain works processes.

In planning the layout of the new central laboratory, the principal aims have been to keep related functions together. The laboratory for the mechanical testing of lubricants, the machine shop, engineering laboratory, cold chamber, radiography room, battery-testing laboratories and laboratory for mechanical testing of metals will be on the ground floor. On this floor will be the metal-chemistry laboratory and rooms for microscopy, non-destructive testing, and technical photography. The physics laboratories and photometry room, main stores, and rooms for the preparation of reagents and for the cleaning of sample bottles and glassware will be also on the ground floor.

The upper floor will have groups of laboratories for the testing of fuels and lubricants, paints and allied materials, and textiles, and for general chemical work of an exceptionally wide range. In each group, one or more small laboratories are to be provided for investigational and research work and, in particular, one of the chemical laboratories has been designed to be suitable for work involving the use of radioisotopes at a low level of activity.

Work of the laboratory will include longer-term investigations in the nature of technical research. Such work is always in progress and some notable successes have been achieved, particularly with lubricants for road vehicles. Much valuable work has also been done in connection with metal protection, painting processes and the design of lead-acid accumulators.

The improved cold chamber facilities will further assist in the development of conductor rail de-icing fluids, in the testing of alternative methods of de-icing, and in investigating problems relating to the performance of air-operated and other mechanical and electrical equipment under low-temperature conditions.

New items of equipment for the chemical laboratories will include visible and ultraviolet spectrophotometers, a flame photometer and an automatic titration apparatus. The large amount of apparatus and equipment, much of it up to date, now in use in the various laboratories will, of course, be transferred to the new building.

The new central laboratory has been designed to the requirements of Mr. A. T. Wilford, A.R.C.S., B.Sc., F.R.I.C., C.I.Mech.E., F.Inst.Pet., director of research, London Transport.

Possible U.K. Contracts with Euratom

BRITISH firms who think they can do business with the European Atomic Energy Community are recommended by the Board of Trade to communicate with the U.K. Delegation to Euratom, 64 Rue de la Loi, Brussels.

The Board of Trade state: "Because Euratom has no direct powers at the present time to construct nuclear power stations and ancillary plant, it is not clear what advantages can accrue from contact between British industry and the Euratom officials. However, Euratom has a sizeable research and development budget and intends to set up a common research centre (which may be at Ispra, near Milan, with other sections possibly in the Netherlands and Germany). This research centre will carry out a programme of its own and will also let extra-mural contracts for research and development work and for equipment for research purposes. It may also at a later stage embark upon the design and construction of experimental reactors and plant.

"There may well be opportunities for British industry to supply equipment to support these projects and to form associations with the research centre, thus creating openings at a later stage for the sale of plant or know-how on a larger scale to European industrial concerns working either on the Euratom research and development programmes or upon major plant designs arising from these."

Big Fall in Capital Spending on Chemicals

In the first quarter of this year, fixed capital expenditure by the chemical and allied industries was nearly 13% less at £30.2 million than in the corresponding quarter of 1958, according to the Board of Trade. Total expenditure in 1958 was £159.9 million.

★ I HEAR that several British car manufacturers are now turning to the new petrol-based plastics foam—polyether—for upholstering seats. Mr. Davis Millar, managing director of Aeropreen Products Ltd., High Wycombe, says: "Polyether foam, which we introduced to this country earlier in the year, is now being used as seat squabs or overlays in a number of models including the Triumph Herald, Sunbeam Rapier and Ford Consul."

Aeropreen, by bringing into operation the largest plastics foam plant in Europe, have pioneered the production of polyether. The motor industry is now taking 35% of the company's rapidly increasing output. Within the last month additional equipment has been installed which will boost total production by 50%.

The polyether type flexible urethane foams are based on either polypropylene glycol systems or mixed polypropylene-polyethylene glycols or derivatives of these. Notable advantages over natural rubber include resistance to oxidation and controlled values for resilience and hardness.

★ AFTER nearly 18 months of negotiation, a research and development agreement for the Sicilian sulphur industry has been signed in Rome. The West German company, Weruschacht GmbH, Essen, are to plan re-organisation of sulphur production and processing in Sicily by the State Sulphur Board of Italy, Ente Zolfi Italiani.

Cost of the research and planning programme will be about £134,000, of which about £42,000 will be met by the State. At present the Sicilian sulphur industry employs 12,000 workers to produce some 200,000 metric tons of pure sulphur a year; obsolete and outdated equipment and plants, however, make necessary the payment of Government subsidies to the industry. It is estimated that planning will take about one year.

★ BASED on their experience of handling high test peroxide (H.T.P.), which amounted to 50,000 gall. during the first year of flight trials with the S.R.53, Saunders-Roe Ltd., Osborne, East Cowes, I.o.W., have published a brochure on the safe handling of the material. Concentration of H.T.P. for use in aircraft rocket engines is about 87%; the engine develops its thrust, primarily from the rapid decomposition of H.T.P.; the principal catalyst now used is silver.

The properties of H.T.P., compatible materials, and the treatment of such materials, are not dealt with in detail. The booklet, however, does provide methods of handling which have been proved in servicing the aircraft system. It covers every type of operation; removal of bag tanks, replacement of components, fault finding, examination and testing. Refuelling and defuelling is carried out with no more concern than when the fuel is either gasoline or kerosene. Handling experience also includes the collection of bulk supplies in 2,720 gall. rail tankers and delivery to storage tanks.

The booklet describes the types of protective clothing and equipment, such as valves, most suitable for us with H.T.P.

★ NEWS of corrosion-prevention measures adopted when handling tricresyl phosphate (TCP) has reached me from Celanese Corporation of America. TCP, valued as a plasticiser for its solvent powers and flame-retardency, is also a motor fuel additive.

To prepare TCP, cresylic acid is reacted with phosphorus oxychloride, hydrochloric acid being formed as a by-product. Acid constituents present during the reaction make corrosion protection a necessity. Celanese Corporation who make several grades of the material at their Point Pleasant Works, are now using tanks of nickel for storing hot crude TCP containing hydrochloric acid, and nickel-clad spherical vessels for further processing of the crude acidic tricresyl phosphate.

Nickel has been used not only because of its resistance to corrosion, but also to prevent the possibility of stress-corrosion cracking due to the presence of chlorides.

★ ONCE AGAIN Britain has led the field in a major new scientific development—that of the hydrogen fuel cell. This project has been a life's task for Mr. F. T. Bacon, to whom great credit is due; it could herald a new era in power.

There is the danger, however, that the lead provided by this pioneering research work may—as in other notable instances—be exploited so far as commercial development is concerned, by the U.S. American companies have already taken over Italian research workers in this field and approaches can be expected to Mr. Thomas's enthusiastic team, if they have not already been made.

The urgent need is for a large British company—preferably one with access to cheap hydrogen and tonnage oxygen—to take up the N.R.D.C. patents.

★ POLYESTER fibres may soon compete with nylon and rayon for the tyre cord market, believe the Firestone Synthetic Rubber and Latex Co., U.S. They base their opinion on results obtained on more than a million test miles on tyres incorporating polyester fibre cord.

At present, cost is a major factor since Dacron, Du Pont's fibre and the equivalent to I.C.I.'s Terylene, sells at $1.50 per lb., compared with $1.20 for nylon. Firestone consider they can sell polyester cord tyres, however, at competitive prices, if production is on a commercial scale. Advantages of using polyester fibre are said to include no flat spotting, increased mileage and an improved ride.

Before deciding to market polyester cord tyres, Firestone plan to carry out more road tests.

★ EXPERIMENTAL use of psychochemical agents on U.S. troops is disclosed in a report by the U.S. Congressional committee on science and astronautics. Previously classified details about these agents, which have been developed in the past five or six years are given. Their exact chemical nature is not disclosed, except that some are derivatives of lysergic acid.

Psychochemical agents can incapacitate men temporarily without any permanent damage. Troops exposed to the agent could not follow simple commands or perform normal tasks with accuracy. They were not aware of their behaviour, which was, of course, evident to observers. Two general groups of psychochemical agents have been tested: one causes temporary physical disability such as blindness, deafness or paralysis; the other temporary mental aberration.

These agents which could revolutionise battle strategy, are not yet ready for use. I understand that with a bigger research and development programme they might be ready in under 10 years.

★ PROPECTS of establishing a $35 million chemical complex in Manitoba are being studied following a survey carried out by Arthur D. Little Institute of Cambridge, Mass., who were engaged by the Provincial Industry and Commerce Department. The survey suggests that Manitoba's best bet would be a Shawinigan-Quebec type complex based on two basic raw materials—limestone and salt. Such a plant would produce vinyl chloride, chlorinated methanes, perchlorethylene and vinyl acetate.

The Little report was less optimistic about other chemical fields. The local market is small and freight costs to larger markets are high. The chlorine-acetylene complex offers promise if certain conditions can be met. These include large blocks of power at low cost; long-term supply of cheap coke; finding of markets for by-products—including caustic soda, carbide and chlorine as well as for the upgraded chemical intermediates; writing-off of investments would be over seven years, rather than five years.

The complex envisaged would include a plant near Winnipegosis to convert regional limestone into calcium carbide and another integrated works in the Virden area to combine chlorine, made from available brine, with acetylene produced from the carbide, or with methane from the natural gas pipeline.

Alembic

CAMBRIDGE POLAROGRAPHY CONGRESS

300 Delegates Hear New Work of Value to Industry and Research

MORE than 300 delegates representing some 20 countries gathered in Cambridge on Monday this week to attend the Second International Congress of Polarography from 24 to 29 August. The congress, a direct successor to that held in Prague in February 1951, has been arranged to mark the 70th birthday of Professor J. Heyrovsky, the founder and president of the Polarographic Society. Professor Heyrovsky, due to ill-health, was unable to be present in person and to deliver the inaugural lecture. It was read for him by his son, Dr. Michael Heyrovsky.

Patron of the Congress was Sir George Thompson and the office of president was taken by Professor H. J. Emeleus who opened the Congress at the Guildhall. Plenary lecturers were Professor Paul Delahay, Department of Chemistry, Louisiana State University, Baton Rouge, Louisiana, U.S. (Electrode Processes in Polarography); Dr. H. N. M. H. Irving, Oxford University (Polarography in the Study of Metal Complexes); Professor W. Kemula, Warsaw, Poland (The 'Hanging Drop' Method); and Professor Dr. M. von Stackelberg, Bonn, West Germany (Polarographic Maxima).

In addition to the four plenary lectures, six section lectures were delivered. The six sections were: Instrumentation, theory and kinetics, analytical and industrial applications, fundamental studies, biological and medical applications, and miscellaneous. Section lecturers were Dr. G. C. Barker, A.E.R.E., Harwell (Oscillographic Polarography and Radio Frequency Polarography); Professor O. H. Müller, Department of Physiology, State University of New York, Syracuse, N.Y. (Rate-Controlled Reactions as Illustrated by the Reaction of Pyruvic Acid); Dr. G. W. C. Milner, Analytical Chemistry Group, A.E.R.E., Harwell (Analytical and Industrial Applications of Polarography); Professor R. Brdicka, Prague, Czechoslovakia (Kinetic Currents in Polarography); Dr. I. S. Longmuir, Department of Biochemistry, Institute of Diseases of the Chest, Brompton Hospital, London (Biological and Medical Applications); and Dr. V. S. Griffiths, London University (Education Training in Polarography).

During the week more than 100 papers were delivered by members. One Russian paper was presented and two from Japanese workers. Many new techniques and developments were recorded and the congress papers generally were of a high standard. The proceedings of the congress including plenary and section lectures, papers and discussions will be published in due course by Pergamon Press.

Short reports on the papers are given below.

Kemula on the 'Hanging Drop' Method

IN A plenary lecture, Professor W. Kemula, Warsaw, referred to the simple model of the hanging mercury drop electrode (*Analytica Chimica Acta* 18, 104 (1958)) which has been applied to the solution of analytical and physico-chemical problems.

In analytical chemistry the method of deposition of different ions on mercury to form the amalgams, and subsequent recording of oxidation currents of this amalgam, when the normal polarographic arrangement is used, has made it possible, he noted, to raise by 1,000 times the sensitivity of the analysis of Cu, Bi, Pb Tl, In, Cd and Zn to 10^{-9} mol/l. The separation of Pb and Tl or Cd and In is complete.

Dr. Kemula has recently investigated the physico-chemical problems of inorganic and organic character. The inorganic problems are: the elaboration of the method of detection and estimation of the composition of intermetallic compounds formed in mercury; the investigation of the mechanism of the formation and properties of amalgams of Fe, Co and Ni; and finally the measurements of kinetics of formation of intermetallic compounds in mercury by chronopotentiometry.

Investigation of organic molecules has been done by the method of cyclic voltametry, when i-V reduction and oxidation curves are cyclically recorded.

This method, Dr. Kemula reports, has an advantage in that intermediate transition radicals and molecules products of reduction and oxidation can be detected and investigated.

It could be stated, he said, that range and frequency of the applied potential plays an important role in the detection of these products, which has been shown during the investigation of several compounds.

L. to r.: G. F. Reynolds, congress chairman, Prof. W. H. Linnell, vice-president, presenting the society's medal to Prof. R. Brdicka, Prague, and Prof. H. J. Emeleus, congress president. Prof. Brdicka received the medal on behalf of Heyrovsky

Continuous Analyses by Polarography

The problem of application of the polarographic method to continuous measurements of concentrations of technically important substances not only in a laboratory, but also directly in the course of industrial work was dealt with by Dr. J. V. A. Novák and Dr. J. Tenygl,

Professor J. Heyrovsky, who has been awarded the society's medal, was unable to attend owing to ill health

Polarographic Institute, Czechoslovak Academy of Sciences, Prague. The main problem has been to find suitable electrodes. Electrodes of the second class, which have been used up to this time for reference, become polarised and passivated through the long passage of the current; to avoid this they were substituted by different electrodes of the first class so that the depolariser of the electrodes of the second class would not disturb the electrode process at the indicator electrode.

Novák and Tenygl have found mercury dropping electrode as the indicator electrode successful for continuous measurements of long periods in laboratory work. Difficulties were encountered only in the case of insoluble products that block the capillary. Some stationary electrodes were also used as indicator electrodes, the electrolyte at the surface of these being stirred by bubbling of a gas or by the flow of the electrolyte. The main properties of these electrodes are: no capacity current, simple device and high sensitivity.

Polarographic currents obtained with these electrodes are so great that they

Organising committee, l. to r.: Mrs. B. Lamb, chief chemist, Evershed and Vignoles; D. R. Curry, Mineral Resources Division, Colonial Office; K. Baker, S.E. Essex Technical College; G. F. Reynolds, M.o.S. Chemical Inspectorate; G. Russell, senior chemist, Ilford Ltd.; Miss C. J. Arlidge, British Iron and Steel Research Association; Dr. I. S. Longmuir, Institute of Diseases of the Chest, Brompton

may be recorded by conventional recorders it is reported. Also the carbon electrode is very useful, particularly for measurements of the anodic current. When insoluble products of the electrode reaction are formed, several methods of automatic regeneration of the electrode surface in the course of measurements were worked out.

Improved Cathode-ray Polarograph

An improved single sweep cathode-ray polarograph for research purposes was described by Dr. Luigi Grifone and Dr. Elio Vianello, Physical Chemistry Institute, University of Padua, Italy. All the parameters of an oscillographic measurement, such as voltage and current sensitivity, sweep rate, delay and measure time, are adjustable within large ranges, both in oxidation and reduction processes and the essential feature of the device is the absolute certainty of an accurate synchronisation.

Differential Double-Layer Capacity of Mercury

A new method for the measurement of double-layer capacities was described by Dr. G. C. Barker and R. L. Faircloth, A.E.R.E., Harwell, which is said to be particularly suitable for use in conjunction with a square wave polarograph or a square wave impedance analyser.

A small triangular voltage is superimposed on the polarising voltage which is applied to the electrodes of a polarographic cell and the double-layer capacity of the dropping mercury electrode is found by measuring or recording the amplitude of the square wave component of the cell current which is associated with the charging and discharging of the double-layer capacity. By varying the time in the triangular wave cycle at which the current amplitude is measured the effect of any pseudo-capacity connected with a reversible or an irrevisible reduction can be greatly reduced.

Capacity data for concentrated solutions of various electrolytes were given. Specific adsorption of certain reducible metal ions from halide solutions, it was stated, produced appreciable changes in differential capacity; this adsorption had some bearing on the polarographic maxima observed during the reduction of these ions.

Polarographic Behaviour of Nitrate & Nitrite in Strongly Acidic Medium

Polarographic behaviour of the system resulting from addition of nitrate or nitrite to a strongly acidic medium has been studied by J. Masek, Polarographic Institute, Prague. When increasing the concentration of sulphuric acid a wave at 0.0V (against the mercurosulphate electrode in 18M H_2SO_4) appears with nitrates at a concentration of about 14M H_2SO_4. From 14M to 15M this wave increases and from 15M to 18M its height remains constant. In the range between 14M and 15M H_2SO_4 the wave attains a kinetic and even autocatalytic character. At higher concentrations of sulphuric acid the wave exhibits at room temperature a diffusion character which turns with decreasing temperature into a kinetic one.

Experiments with a vibrating platinum electrode have shown, Dr. Masek states, that this wave is composed of two waves corresponding to two independent processes. The whole system shows a time dependence resulting in the development of a further kinetic wave with $E_{\frac{1}{2}} = -0.95$V against the above defined electrode. In the range from 16.5M to 18M H_2SO_4 an adsorption wave appears with $E_{\frac{1}{2}} = -0.8$V.

Nitrites show a similar behaviour. The wave at 0.0V and −0.95V appears at a concentration of sulphuric acid of 2M. In addition, in the whole acidic range up to the concentration of sulphuric acid 8M a wave with $E_{\frac{1}{2}} = -1.3$V is shown corresponding to the reduction of nitrous acid. Both in case of nitrate and nitrite the polarographic behaviour is complicated by homogeneous kinetics in the solution, the equilibria containing gaseous components.

New Method for Oxygen Analysis Using Platinum Micro-electrode

A group at British Oxygen Research and Development, Deer Park Road, London, have developed a new method for oxygen analysis. Principle of the method is the use of a platinum microelectrode as a capacitor; the electrode is charged to a fixed potential by means of a condenser, the source of charge is then removed and the electrode potential measured after a fixed time interval. It is found that under certain conditions the loss of charge by the electrode is proportional to the oxygen concentration of the solution in which it is immersed.

The sequence of re-charging the electrode system, removing the charging source, and measuring the charge lost by the electrode can be made repetitive; and the instrument described is based on this repetitive principle.

Advantages of the method are that very little passage of current is involved, and results do not depend, as in diffusion current measurement, on the electrode area. This enables very small electrodes to be used and renders the method suitable for medical work and industrial purposes.

Circuits were described by the British Oxygen Group which allow full scale selection of ranges covering from 0 to 1 up to 0 to 100% oxygen, based on the gas in the equilibrium with the cell liquid.

A prototype instrument has been developed and was demonstrated.

Cathode-ray Polarograph in Analysis of Blasting Explosives

Blasting explosives usually contain nitroglycerine and dinitroglycol and in addition they may contain mononitrotoluene. Analysis by classical chemical procedures is tedious, because a number of stages are involved. The presence of the NO_2 group in these compounds renders them suitable subjects for the application of polarographic techniques.

Preliminary experiments by A. F. Williams and D. Kenyon, I.C.I., Nobel Division. Research Department, Stevenston, show that is not possible to apply the conventional polarograph to the accurate determination of nitroglycerine, even when present alone; indeed, with low sensitivity and high damping the waves remain unsuitable for accurate measurement. Williams and Kenyon have found, however, that nitroglycerine can be readily determined by using the cathode-ray polarograph. Employing a tetramethylammonium iodide aqueous-methanol base solution, nitroglycerine gives three plateaux of the irreversible reduction type which occur at potentials of −0.25, −0.45 and −0.77V. By using the first plateau, since dinitroglycol reduces at −0.45 and −0.77V and nitrotoluene reduces at about −0.80V, the nitroglyerine can be directly determined in the presence of dinitroglycol and nitrotoluene.

A peak typical of a reversible reduction is given by the isomers of nitrotoluene and coincides with the third plateau due to nitroglycerine. The relatively high sensitivity of the nitrotoluene reduction makes it comparatively easy to measure its peak and then subtract the height denoted by the less sensitive nitroglycerine and dinitroglycol reductions.

Determining Traces of Sulphur in As and In for Semiconductors

Determination of traces of sulphur in arsenic and indium for the semiconductor industry was described by J. A. Clements and A. E. Purkis, Mining and Chemical Products Ltd., Alperton, Middlesex. The sample is dissolved in a mixture of hydrobromic acid and bromine and the bulk of the major element is removed by a solvent extraction process. The solution is then evaporated to dryness on a water bath. When arsenic is being analysed this stage removes the last of the arsenic by volatilisation.

The residue is taken up in a small amount of dilute acid and after adjustment of the pH of the solution the trace metals present are extracted by 8-hydroxy-quinoline in chloroform. This process also removes the last of the remaining indium. The solution is evaporated to dryness and the residue is dissolved in the electrolyte and diluted to a suitable volume. The electrolyte consists of aqueous ethanol, containing lead nitrate, hydrochloric acid and suspended lead sulphate. The decrease in peak height is proportional to the sulphur concentration over a limited range. Figures are given to show the interference of some other elements.

Effects of Phosphate in Polarography of Uranium in Acid Media

Further studies have been carried out by Drs. H. E. Zittel, M. T. Kelley, F. L. Conover and G. R. Wilson of the Analytical Chemistry Division, Oak Ridge National Laboratory, Tennessee, on the previously reported anomalous behaviour of U(VI) in the presence of orthophosphate. The poorly defined waves described by previous investigators have been found to be due to the occurrence of two separate waves.

This phenomenon, these workers have found, can be prevented by the presence of small amounts of perchloric acid. In solutions containing 0.1 M $HClO_4$ and from 0.3 M to 1.0 M H_3PO_4 well-defined waves are obtained; the diffusion current is a linear function of the uranium concentration and is very nearly independent of phosphoric acid concentration over this range.

Effect of HCl, HNO_3, and H_2SO_4 on the diffusion current has also been studied, and it was found that only H_2SO_4 exerts a pronounced anion effect on the height of the U(VI)-U(V) reduction wave. In the case of the strongly complexing oxalic, tartaric, and hydrofluoric acids very marked anion effects have been noted.

In solutions of strong acids as low as 0.1 M the diffusion current departs from linearity with uranium concentration. However, at uranium concentrations below 10^{-3} M the deviation from linearity is so small that it can be safely ignored in the polarographic determination of U(VI) concentrations.

Calcium Chloride as Supporting Electrolyte in Polarography

KHLOPIN in 1947 demonstrated the value of 30% calcium chloride as a supporting electrolyte in polarography but the effect of 'residual' oxygen on the shape of the polarogram and the resulting limitation in sensitivity was apparently not appreciated. For general analytical work, this concentration, however, eliminates the difficulties observed by Reynolds *et al* in a 5M solution of that salt, due to high viscosity, high ionic strength and low water free energy; but except for a publication by Paccagnella and Fontanella the use of 2.7M calcium chloride has not been widely adopted, which A. S. Landry, International Co-operative Administration, c/o American Embassy, Lima, Peru, considers unfortunate since nitrogen aeration is not required with this supporting electrolyte.

For many years the Khlopin technique has been applied in all the Latin-American occupational health laboratories, since it was more versatile than the Landry method published in 1947, but upon recently using controlled potential electrolysis in the purification of calcium chloride the oxygen effect was discovered. Consequently, the optimum parameters, including pH, concentration, reaction time, stability and reproducibility relative to the use of sodium sulphite for the chemical removal of the residual oxygen have been studied. As a result, the following technique was developed.

Using a final concentration of 2.7M calcium chloride as a supporting electrolyte, the polarographic determination of lead or cadmium is effected without nitrogen aeration through the use of sodium sulphite to reduce the last traces of dissolved oxygen to an insignificant level. An internal standard, such as cadmium in the determination of lead (or vice-versa) is added to the dissolved atmospheric sample which is then brought to dryness.

Oxides of nitrogen are eliminated by a second evaporation to dryness in the presence of concentrated hydrochloric acid and the sample redissolved in a few millilitres of the latter followed by 45 ml. of 3M calcium chloride (of which 30 millilitres in three portions of 5 and two of 15 ml. serve to rinse the original recipient) for subsequent quantitative transfer to a 50 ml. volumetric flask. After addition of modified Tashiro's indicator, that was found to have distinct colour changes at various intermediate values, and using ammonia in concentrations of 1:10 and 1:100 the solution is brought to pH 6.0 or yellow-buff end point. After adding 1.0 ml. of 0.25% sodium sulphite, the solution is made to volume with distilled water at 20°C. and the polarogram obtained.

Prof. W. Kemula, Warsaw, left, and Prof. L. Tachi, Japan

Instrumental conditions and concentration relationships of lead-cadium have been selected so that levels of metal approaching the threshold limit (for the recommended volume of atmosphere sampled) can be read on the lower segment of the reference curve (that serves for either type of analysis) and still permit the evaluation of quantities that exceed this limit by a fivefold factor without recourse to dilution of the sample.

Considerably greater quantities of these metals can be readily determined, Landry states, by simply reducing the sensitivity of the recorder (or galvanometer) response which is the major advantage of the polarographic technique in the analysis of toxic constituents in an atmospheric sample.

Determining Zinc in Pyrites Residues

In recent years pyrites residues, by virtue of their high iron contents, have been used to a considerable extent in the preparation of the sinter burden in modern blast furnace practice. Analytical control of the iron-making process involves the determination of the main constituents iron, 'insol', lime and sulphur together with the minor elements copper, zinc, lead and cobalt, which may adversely affect the process.

Absorptiometric methods for these elements together with a polarographic technique for zinc have been developed in the Central Laboratory, Appleby-Frodingham Steel Co., Scunthorpe, Lincolnshire, reports Dr. T. S. Harrison.

In the polarographic method the sample is dissolved in aqua regia, silica is removed by baking and iron by ether extraction from hydrochloric acid solution. Ammonium chloride, a known excess of ammonia and a little gelatin solution are added, followed by dilution to a given volume. The solution is transferred to the polarographic cell and a reading taken on an instrument zeroed at 0.8V. and calibrated against a pure zinc solution. Alternatively, the internal standard method is very satisfactory.

Results agree closely with those obtained by the company's dithizone absorptiometric procedure or classical H_2S separation, Dr. Harrison indicates. Similar methods for copper and lead are also being developed.

Boron is Effective as Timber Preservative, says Carr of Borax

TECHNICAL evidence on the toxicity of boron to certain wood destroying organisms, and an outline on certain concepts associated with the development of a preservative essentially for building construction was given by D. R. Carr, Timber Department, Borax Consolidated Ltd., at a recent conference of the British Wood Preserving Association.

Boron as a fungicide has been tested by a variety of laboratories including Forest Products Research Laboratories, Princes Risborough, in Madison, U.S., by D.S.I.R. in New Zealand. As yet, no wood rotting test fungi have been found to exhibit any appreciable degree of tolerance to boron. With sapstain fungi, addition of borax to chlorinated phenates has been found to give better or equal protection at lower cost than chlorinated phenates or organic mercurials on their own.

Recent tests conducted under laboratory conditions have shown that boron is effective against certain termites; the indications are that it is the effect of boron on the intestinal protozoa of the termites and that the destruction of this protozoa leads to destruction of the termites. The effect is thus through toxicity rather than repellency.

With regard to methods of application, complete penetration of all susceptible wood with boron is essential and pressure impregnation is frequently used for boron preservation. The non-pressure methods commonly used with borates are based essentially on diffusion impregnation involving two steps, dipping and storage.

To obtain a specified minimum 'core' retention of 0.20% boric acid equivalent in timber, it has been found that an average 'core' retention of 60% should be achieved. This average 'core' retention, Carr states, is usually associated with an average cross-section retention of about 1.25% boric acid equivalent.

Commercial diffusion treatment plants handle four or five packets of 1,000 bd. ft. per hour and hot immersion in tanks is used followed by diffusion storage. In small works the solution is sprayed on all surfaces of individual timber.

Advantage of boron compounds as wood preservatives is that although highly toxic to wood destroying organisms they are relatively harmless to human beings and livestock. Solutions (30% to 40% H_3BO_3 equivalent) can therefore be handled by workmen without having to observe any special precautions. Another advantage is that as the boron treating solutions are colourless, the wood retains its natural colour.

Treating solution concentrations for diffusion impregnation by momentary immersion are generally 25% to 40% boric acid equivalent, these concentrations being well above the maximum solubilities of boric acid or borax. By using boric acid and borax together, so that one part of boric acid is dissolved with 1.5 parts of decahydrate borate (or 1.8 parts of pentahydrate borax) high solubilities are readily obtained.

Calcium Plumbate Suggested as Pigment

ALTHOUGH known for over 60 years, calcium plumbate was not suggested for use as a pigment in priming paints until the middle of the last war. In 1950, calcium plumbate, which is really calcium orthoplumbate, $2CaOPbO_2$, became available commercially and its use in priming paints for iron and steel has grown steadily since. Makers of the pigment are Associated Lead Manufacturers Ltd., Clements House, 14-18 Gresham Street, London E.C.2.

Although the mechanism of calcium plumbate's protective power is not fully elucidated, The Lead Development Association reports that there is a growing weight of evidence that in a priming paint it protects steel by suppression of both the anodic and cathodic areas of the structure (*Lead News*, Vol. 1, No. 7, May 1959). Another advantage concerns the behaviour of linseed oil paints with sea water. Paints containing this oil blister and soften when applied to a steel structure later exposed to saline spray. It is believed that activity at the cathodic areas is responsible for this occurrence. When calcium plumbate is incorporated in the paint, this effect is not observed (believed to be due to suppression of cathodic activity) and as a consequence the paint has a much longer life.

There are other characteristics of calcium plumbate of advantage to a paint pigment. Its colour is light buff, thereby permitting a wide range of colours to the finished paint; it has a comparatively low specific gravity, so giving a paint with a low weight per gallon; it mixes well with oil to give a good textured paint; its rust-inhibitory properties are so pronounced that incorporation of a fair amount of extender in the paint is possible; paints with calcium plumbate are found to cover well and leave few brush marks; while a film of a calcium plumbate paint on steel will continue to harden and toughen long after coats of other paints have been applied on top.

The alkaline nature of the pigment is considered as being mainly responsible for its beneficial suppression of cathodic activity on steel and is useful as a neutralising agent for harmful acidic breakdown products of organic constituents of paint. It is possible, however, to use calcium plumbate with a fair range of media and it does not appear to affect alkali-sensitive pigments such as Prussian Blue.

Adherence to difficult surfaces is another useful feature of calcium plumbate paints. Thus, they can be applied direct to new galvanised iron without prior use of a mordant or recourse to weathering. As far as is known the remarkable adhesion to galvanised iron is unique among paints. The primers also adhere well to hardwoods and light alloys such as aluminium alloys.

Tenders for Drug Manufacture Equipment

TENDERS for equipment for the manufacture of streptomycin are invited by the International Cooperation Administration, the agency through which the U.S. Government gives assistance to other countries.

The equipment, called for under the procurement for India, consists of glass lines, agitating and crystallisation tanks and reaction vessels, vacuum pumps and pipes for steam, compressed air, process water, chilled water and vacuum.

Specifications and other documents can be obtained from the India Store Department, Government Building, Bromyard Avenue, Acton, London W.3, at $2 a set.

World's Largest All Plastics Vessels

WHAT are believed to be the largest all plastics vessels manufactured to date are being delivered by Cawley Plastics Ltd., Byfleet Road, New Haw, Weybridge, Surrey, to a chemical plant in the Home Counties.

The vessels, in Tugplas, a chemically bonded lamination of unplasticised p.v.c. and glass-fibre/polyester, are up to 32 ft. high and 4 ft. in diameter.

British Road Services last week undertook delivery of the first two process vessels, which for speedy delivery and assembly are made in sections. A further six vessels are being manufactured. The contract also includes two 8 ft. diameter by 20 ft. high tanks.

Sugar Project for C.J.B.

A contract to the value of about £2.5 million has been awarded to Constructors John Brown Ltd., C.J.B. House, Eastbourne Terrace, London W.2, for the supply of a sugar factory at Kavar in Iran. Associated with C.J.B. for the project are A. F. Craig and Co., Paisley, who will supply the equipment. Work will start at once and is scheduled for completion by early 1961. The contract covers the training of Iranian personnel.

B.O.G.'s New Aviation Service

All the specialised activities of the British Oxygen Group to aviation are now being co-ordinated through British Oxygen Aviation Services, a new organisation. Manager will be Mr. J. R. T. Bradford and the company will operate from group headquarters at Bridgewater House, St. James's, London S.W.1.

AUTOMATIC SAFETY EQUIPMENT FOR CHEMICAL PLANT

Automatic Devices and Techniques for Plant Protection and Emergency Shut Down

By
L. S. James
Automatic Control Division, Constructors John Brown, Ltd.

AS MODERN process plants have become more and more complex in meeting the demand for high throughput and a tightly controlled product, automatic devices for presenting warning of abnormal conditions and, if necessary, complete shutdown of the plant, have evolved as a special technique. The equipment is basically a modern working tool calling an operator's attention to 'off-normal' conditions of operation and to ensure that any potentially dangerous situation arising shall become known without delay.

On continuous process plant particularly, the most vital process variables being either automatically controlled or dependent on constant conditions, the prevailing atmosphere in the control room is one of operational stability; circumstances which tend to lull a human operator into such a state of relaxation as to allow the approach of danger to go unnoticed. In addition, the increasing number of measurements made on most processes, with consequently larger and more complex instrument panels, have imposed extensive division of the operator's attention. Provision is made in alarm systems for the trouble to be acknowledged manually; when immediate action is taken to return the process to normal or to shut down the whole plant.

This concept of continuous plant monitoring is part of the evolution of chemical plant control and has developed along parallel lines to the general measurement and control of plant parameters out of which it was born.

Automatic Action Under Emergency Conditions

Human control of a chemical plant involves the combination of a number of mental processes. Logical deduction based on an interpretation of plant information is applied to the appropriate operation of the controls. Past operating experience may have to be applied when logical interpretation breaks down. Furthermore, the decision must be taken whether to act on a basis of logic, or memory, or a combination of both. Commander Sir David Mackworth, R.N., drawing upon his observations of the action of Naval watch officers during the onset of abnormal conditions, such as an impending collision, recalls instances of what he terms 'occasional or long-term (mental) aberrations'. These aberrations take the form that an adequately trained operator supplied with sufficient information to indicate the onset of an abnormal condition, demanding abnormal control action, fails to react to this information until the abnormality has increased disastrously. Indication of an emergency has thus met with a strongly inhibited response.

It is understandable that this effect would most likely occur after continuous normal operation of a plant over prolonged periods of months or even years, during which only normal action is necessary. This appears to build up a restraint preventing rapid switch by the operator from the normal to the abnormal control procedure.

There is little exact evidence to be found that occasional aberration on the part of operators actually occurs on industrial plant. Possibly the managements concerned are reluctant to publish details of such human errors. Nevertheless, evidence does exist which leads one to suspect that this type of aberration has occurred in industry, with consequent damage to plant.

The conclusion to be drawn is that the employment of automatic devices to operate under emergency conditions is a form of assurance against human failure to respond at a critical time. It follows that the devices themselves must possess an inherently high standard of reliability and that provision be made for test *in situ* under simulated conditions of action.

Classifying Alarm Devices For Survey Purposes

For convenience in classifying devices employed for this purpose, they may be considered in conjunction with the abnormalities to be indicated. These may be:

(a) Deviations from set parameters such as, flow, pressure, temperature, level, density, current, or mechanical motion, etc.

(b) Occurrence of 'natural' conditions such as, fire or explosion.

The alarm operation is initiated by the actuation of a thermostat, float switch, pressure or flow switch, relay, or any device that will make or break an electrical circuit. Air-operated systems may be substituted in hazardous atmospheres.

The receiving equipment or mode of warning, may be visual or aural (or, more usually, a combination of both) with manual acknowledgment and ring-back facilities. This equipment may be combined in 'packaged systems' available from several British makers.

Automatic Shutdown Devices. Development from alarm (requiring human intervention to correct the undesirable condition) to automatic tripping or shutdown, may entail the use of auxiliary equipment or involve a separate device which does not itself indicate the action taken. This is provided only when the necessity for speed exceeds the ability of the operator to take appropriate action or where the plant is normally unattended. Again, shutdown would not necessarily follow deviations which are transient or not a danger providing corrective action is taken in time. Shutdown equipment is normally self-acting and self-contained but employed in combination with a primary measuring device or, more usually, as part of an alarm system.

The equipment itself and its application will now be considered in the form of a general survey.

Alarm Initiating Devices

Process variables of flow, pressure, temperature and level are the usual plant parameters, the deviation of which from set values, could rapidly result in danger to the plant. In alarm and shutdown systems, initiating devices derive their action through a measuring movement whose actuating force is derived from physical changes in the variable measured. Most devices provide a switch action (electrical) or air-shut-off (pneumatic) to trigger off the receiving components of the alarm system.

Pressure, vacuum and flow switches employ similar working principles. Most types can be made in certified flame-proof form. The pressure ranges determines the movement used, i.e. bellows, diaphragms, etc., and, to some extent, the differential adjustment available. The 'reset differential' of a pressure switch is the difference between cut-in and cut-out pressures and it may have a built-in differential or be adjustable by means of a differential attachment. This applies equally to tem-

perature switches with gas, vapour or liquid expansion movements.

A comparative differential switch incorporates two pressure-sensitive elements with separate pressure connections. Connected across a filter, the switch gives warning of dangerous build-up leading to possible blockage. Hand reset pressure and temperature switches are used where the switch should operate at a set pressure (or temperature) but the contacts should not reset on the pressure returning to normal.

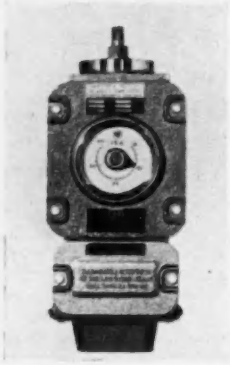


Fig. 1.—Flame-proof pressure switch by K.D.G. Instruments Ltd.

For the switching of inductive d.c. loads, spark-quenching components are incorporated. Where a large reset differential is required, either make or break contacts are fitted.

Pre-warning of increasing danger conditions is obtained by connecting pressure switches in cascade and set at different (increasing or decreasing) values.

Fluid Flow Operated Switches. These may be actuated through a restriction in the flow line or be self-operated by the liquid or gas flow. In the latter case the flow rotates a shaft fitted with an impeller and permanent magnet and once each revolution attracts an armature, opening and closing a pair of contacts. The pick-up equipment incorporates a time delay which maintains a final relay operated so long as the contacts are opening and closing regularly. For pipes over 3 in. and flows higher than about 300 gall. per minute, impeller-type flow switches can be fitted in a by-pass.

Flow switches are used to indicate failure of water or air coolants, purge air or lubricating oil, and also the mistaken operation of a valve where such an error is accompanied by a rapid increase or decrease in flow. Plant protection by automatic interlock is provided by incorporating flow switches in electrically operated valve circuits. Flow switches for low velocity gas or air flows operate on the moving vane principle; Londex manufacture a comprehensive range of flame proof models; Fig. 1.

A switch to detect changes in the flow of solid materials in granular or powdered form is arranged to stop a process or give an alarm on interruption of material flow. The material is caused to fall on a paddle which rotates sending impulses to a relay unit. A delay of ten seconds is incorporated in the relay unit to prevent brief failures operating the alarm circuit (Fig. 1).

Level Alarms. The level-operated device to be used for plant protection is selected by certain considerations as follows:

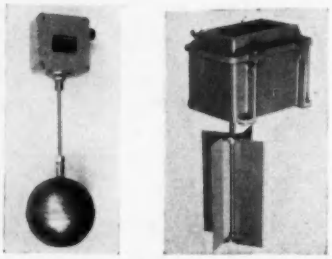


Fig. 2.—a, Material flow switch (paddle type) for granular solids; b, float-operated, single level switch (both by Londex Ltd.)

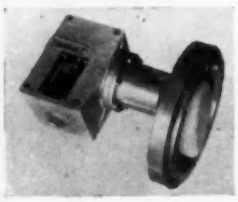


Fig. 2.—c, bellows switch for level control of heavy solids, by Londex

1. Nature of the material, i.e. liquid or solid.
2. Properties of the material, i.e. electrically conductive, corrosive, foaming, etc.
3. Container, i.e. tank (open or closed to atmosphere) hopper, reservoir, etc.
4. Special conditions, i.e. high pressure, hazardous atmosphere.

The following types of level switches are available to cover various combinations of the above conditions:

Electrical probe: No float or moving parts. For conductive fluids, slurries, solids, etc.

Moving float: Mechanical, flameproof. For non-conductive fluids, in open tanks and channels, etc.

Float indicator (magnetic float): For liquid air, acids etc., in high pressure and enclosed vessels.

Diaphragm operated: For free-flowing solids in bins, hoppers, etc.

Air reaction: Non-electrical, no moving parts. For liquids in open tanks.

Light beam and photo cell: Used when no direct contact permitted. For tanks and closed containers.

Radioactive isotope: As above, for solid materials.

Rotation Sensing Devices. These give warning of the slowing down or stopping of machinery and where the speed is high, the well-known centrifugal switch can be employed as a reliable means of detection. But this device is unsuitable for speeds below 500 or 600 r.p.m. For shaft speeds from 300 r.p.m. down to 30 r.p.m. such as applies to stirring machines, there is a rocker-arm operated switch. The rocker arm (motivated by a cam on the shaft being monitored) operates 'make' and 'break' contacts to continuously maintain a relay energised through a condenser (delay) circuit. The alarm operates in the event of failure of any component of the machine protected.

Power Failure Alarms. Continuous chemical processes are greatly dependent on continuity of electrical supply both in respect of power-driven auxiliaries and for the control equipment itself. Mains failure alarms are either battery or clockwork operated. In the latter case a clockwork bell rings when the mains supply to a relay coil is broken. It rings for two minutes on a wind and a visual device indicates the need for rewinding. Visual indication of a healthy supply is provided by a miniature mains neon lamp.

Phase Failure

Phase failure equipment will trip a motor and thereby prevent damage due to overheating should one phase of the supply fail. It operates, despite the generation, by the motor, of a proportion of the missing phase voltage. Devices are also applied for under-voltage protection on single phase or d.c. supplies.

Fire Detectors. The prime requirement is for detection, as soon as possible, after the fire breaks out. Detecting elements fall into two categories, viz: those affected by (a) heat and (b) combustion gases or vapours. Of those affected by heat, the fusible link is well known. It is an inexpensive method but lacks ease of resetting. Automatic resetting is almost essential.

Detectors responding to temperature rise may employ the principle of bimetallic elements having different coefficients of expansion or elements working on thermal expansion. The contacts close at a preset temperature and the construction provides a built-in rate of rise anticipation. Such elements can be installed up to the maximum spacings permitted by British Standard Code of Protection, i.e. up to 20 ft. apart and not more than 10 ft. from any wall. The ele-

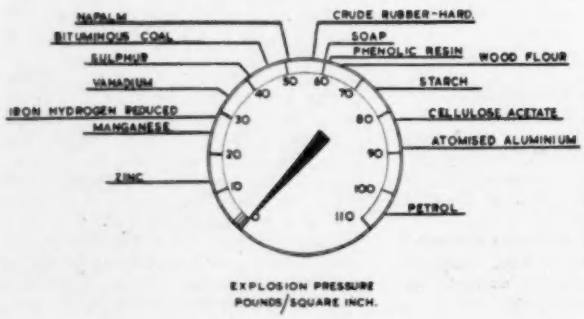


Fig. 3.—Approximate secondary pressures generated by the explosion of various materials. Explosions are detected through the much slower rise in pressure at the start of the explosion

ments are self-compensating for seasonal or other normal changes in temperature.

Smoke Detection Method. Many (chemical) fires produce smoke and fume more readily than heat. In certain cases, flame will die out, with dissipation of the heat generated, but the contamination of the surrounding air by combustion products persists. These products are given off whether or not the burning involves flame or considerable heat.

Recent developments in nuclear technique have proved the means of effecting the positive detection of combustion products. The sensitive element of the Minerva detector (Minerva Detector Co., Richmond, Surrey) is an ionisation chamber; a device in which the air is rendered electrically conducting because of the presence of radium. An electrical bridge is formed by a second (closed) chamber connected in series to form a voltage divider. When combustion products cause the ionisation chamber to radically change its electrical characteristics, the resultant rise in potential triggers a cold cathode electrometer tube which consequently passes sufficient current to operate the alarm system relay.

Each detector will provide cover for 1,000 square feet and their location is established by a careful survey to determine the likely pattern of smoke distribution to be expected from small fires starting in any part of the area.

Explosion Detection and Suppression. Explosions are a potential hazard in any plant where finely divided inflammable materials are produced, i.e. synthetic resins and other plastics, sulphur, aluminium, magnesium, etc., and in fuel and pulverised coal systems and in grinding, dust collecting and extraction systems.

In the initial stages of an explosion, pressure rises comparatively slowly in comparison with the speed of the rise of pressure which follows. Explosion prevention makes use of this phenomena for early detection to suppress the (catastrophic) rapid secondary rise of pressure before it progresses beyond control. In addition to suppression there are four other methods being used to give protection against explosion risks, viz.: venting, advance inerting, isolation and automatic plant shutdown. These may be used singly or in combination.

In suppression it is necessary for the detection of the explosion and the introduction of the suppressant to take place within the vessel where the explosion is initiated. In addition to extinguishing the explosion flame by chemical action and cooling, it inerts any unburnt explosive mixture.

Venting is a method where the explosion is allowed to exhaust itself to atmosphere and most designs of vent rely on the explosion pressure to burst or operate them. But the Graviner detonator-operated bursting disc is operated by means of an explosion detector used in conjunction with an electrical power unit.

Advance inerting is a technique which involves the introduction of a suppressant into a section of the plant away from the seat of an explosion to prevent a secondary explosion, or fire, which may be caused by the propagation of flame or the passage of burning material. This method is usually employed in conjunction with isolation or with other methods of protection.

Among the many types of plant protected by explosion detection and suppression equipment are grinders, pulverisers, cyclones, bag filters, spray and ring driers, bucket elevators and pneumatic conveyors.

(To be concluded)

Safety First for One of Britain's Largest Delivery Fleets for Chemicals

MEASURES to obviate any risk of an accident when chemicals are being delivered by road by the General Chemicals Division of Imperial Chemical Industries Ltd. are described in an article by George A. Hutchinson in the *Leyland Journal* (July 1959).

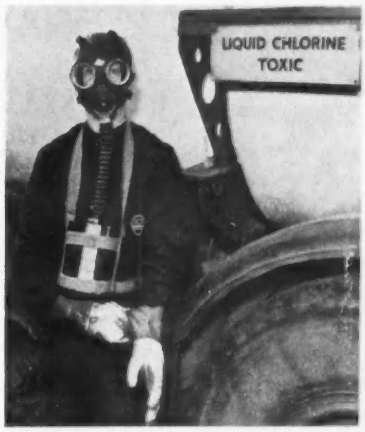
Although the purpose of the safety scheme is the prevention of accidents, he says, it is also geared to swing into action in a matter of minutes should occasion arise. A telephone operator and works cars are on duty 24 hours a day at the Runcorn, Cheshire, works for emergencies.

A fleet of 221 vehicles distributes chemicals over the whole of Great Britain. Drivers undergo yearly examinations. After the initial examination a would-be driver has to pass a school of motoring test after which he attends a short course in the works to learn about the products he will be delivering. He is then accompanied by I.C.I.'s own driving instructor, who also gives lessons in the loading and discharging of the vehicle. When he can deal with one chemical he is given further courses to make him able to discharge any of the normal run of products.

All drivers are given protective clothing for wear during discharging, the standard outfit being respirator, goggles, gloves and p.v.c. cap, jacket and trousers. For certain types of hazardous chemicals there are special outfits.

All vehicles carry a first-aid box. When certain types of chemical are being carried, the first-aid kit contains special medical supplies. This special kit is sealed and only a doctor is permitted to open it. Most of the articulated outfits in the fleet have a fire screen behind the driver's cab—even when this is not specified by Home Office regulations. All the vehicles carry a normal fire extinguisher, but those carrying inflammable liquids are equipped with a special fire extinguisher, depending on the product.

Three information plates are fitted on all tankers. These signs have a background colour such as red or yellow according to the principal hazard of the load being carried. Red signifies that the product is inflammable and yellow means toxic or poison. Each plate identifies the product carried by name, with its hazards, and also gives the telephone number of the office at Runcorn.



Protective clothing and equipment issued to I.C.I. drivers who deliver liquid chlorine

As soon as a message is received one of the cars picks up a team of men who actually make the chemical concerned and rushes them to the scene, together with the vehicle breakdown crew. Meanwhile, the operator informs the caller that an I.C.I. team is on the way and gives instructions regarding the best immediate action. This information the operator gets from a chart which also gives the correct first-aid treatment.

Under a scheme developed by the Association of British Chemical Manufacturers all chemicals carried in carboys or packages are despatched with tie-on warning labels.

The vehicles are brought in fortnightly by night for a safety check on all parts. Once every eight weeks vehicles are docked for a more thorough examination. At this time delivery hoses, valves and gauges are changed. The tanker barrels are given a complete inspection, the frequency of which depends on the product they carry. They are opened up, cleaned out and hydraulically tested. At this stage any major repairs are effected.

Final check on valves of an I.C.I. road tanker carrying liquid chlorine

INSPECTORS HAVE TRADITION OF CO-OPERATION WITH FACTORY MANAGEMENTS

WHEN the first inspectors entered British factories in 1833 they began to build up a tradition of co-operation with managements. Today the relationship is a long-established one of trust and interdependence. Whatever may have been the case in the early days, they are not regarded as intruding policemen, but are welcomed as valuable partners in industry. (They have a motto "A safe factory is an efficient factory" and managements learned that lesson long ago.) Managements know that measures to protect the health and safety of their workers are not only desirable—and enforced by law—but lead to efficiency and increased production. Apart from personal considerations, accidents can deprive a company of the services of valuable workmen, stop production and result in heavy material loss—especially in the case of fires—but on top of this they usually indicate inefficiency somewhere.

Early Advice

Factory inspectors do valuable work in existing factories but even more important work in giving advice before new factories are built.

They are often called in before the architect has put pencil to paper. Safety measures are not added to plans already made but are the starting point. The management say, "This is the sort of factory we have in mind, this is what we are going to produce, tell us what we ought to do." When the factory inspector has given his advice the plans are prepared.

Early legislation, beginning with the first Factories Act in 1803, applied to the textile industries and was concerned chiefly with the conditions of apprentices from the workhouses. Later acts applied to factories of all kinds.

Modern practice is governed by the Factories Act of 1937 as amended by the Act of 1948. Another amending bill is at present before Parliament.

Questions concerning the inspection of chemical factories were put by a representative of CHEMICAL AGE to a senior official of the Ministry of Labour and National Service and received the following replies:

How many inspectors have you visiting chemical factories?

There are about 300 inspectors, working in 14 divisions and 97 districts, but they inspect factories of all types.

You do not have special men for special types of factory?

No. Inspection in the first place is done by general inspectors. Experience has shown that this method produces the best results. The fundamental technique of inspection is the same for all factories. But the general inspectors have the backing of chemical inspectors at headquarters who have had special training. Even the experts must have done at least two years in the general inspectorate, however, because experience in the technique of inspection is very important in addition to expert chemical knowledge.

Do inspectors pay regular visits to factories?

No. If visits were regular, or announced in advance, the inspector would not see the factory in its normal working condition. It is not that managements would be deliberately attempting to pull wool over his eyes, but inevitably that special measures would be taken. From the management's own point of view it is important that the inspector should see things running normally, because he can often see where an improvement is needed.

Are there special rules covering safety in chemical works?

There is a code of regulations for chemical works covering such points as ventilation, entry with breathing apparatus into vessels containing toxics, and dust and vapour explosions.

Do you find that a factory's own safety officers do valuable work?

Yes, safety officers and safety committees are useful, but managements must give them full support and realise also that every man in the works has a responsibility to himself and his mates. He must be encouraged to report anything that is not right and to suggest how things may be made safer.

How can workers be persuaded to observe safety regulations?

It is important that it should be made as easy to work with a safety device on as with it off. If safety precautions mean trouble to the workers they are apt to ignore them. The ideal state is reached when the safe way is also the easy way. Safety measures must be concerted throughout the factory and everyone must be encouraged to back up the management.

From what you said earlier it would appear that chemical firms are usually co-operative in safety matters. Is that so?

Yes. So far from having to be persuaded or compelled to obey regulations, the large chemical manufacturing companies have pioneered measures for protecting the health and safety of their workers. Many of the measures they have taken have been the result of asking for the advice of the inspectors. Good intentions on the part of the factory owners are important, but inspectors can see things that managements do not appreciate, and co-operation between them brings good results.

What special steps do inspectors take when a factory is handling a new chemical?

They naturally rely on their knowledge of related chemicals and know what to look for in new substances. And they play for safety.

The Medical Research Council, with its big well-equipped laboratories, does valuable work in testing toxicity and many experiments are carried out on animals.

International literature is studied and inspectors are always adding to their knowledge.

Chemical aspects have to be studied in relation to other points. Physical conditions can make a substance more dangerous; for example, grinding smaller can make it more explosive.

Added to the knowledge and experience of the inspectors on the spot there is the vast knowledge of materials and practical knowledge of the headquarters staff to put them on the right lines for new projects.

Safety in the Chemical Industry

Pages 221 to 224 of this issue contain features prepared specially for our 20 June issue on 'Safety in the Chemical Industry'. Owing to the printing dispute these pages had to be omitted from our 20 June issue.

Epoxide Pipes for Power Station Effluent

RECONSTRUCTION of drainage systems at Battersea generation station has involved the use of about 1,000 ft. of large-diameter reinforced epoxide pipes, making it the biggest installation of this type of pipework in Britain. The epoxide pipe has replaced ceramic pipe in a system carrying effluent from flue-gas washing plant, located in two of the four chimneys, to a treatment unit from which the effluent is eventually discharged into the Thames.

The effluent, after discharging the larger ash particles into settling tanks, contains some sulphuric acid, and owing to its remaining ash content is highly abrasive.

All the new pipes, manhole covers and fittings are made from Bakelite epoxide resin, reinforced with glass fibre and Terylene, the latter giving added abrasion resistance to the inner surface of the pipes. The pipework was manufactured and installed by Mendip (Chemical Engineering) Ltd.

Two diameters of pipe are used in the installation, 18 inches and 15 inches, and some are of elliptical cross section to fit into narrow positions.

In the S.W. chimney, the down pipes from the washing plant are encased in concrete along part of their length, and the original ceramic pipes have, therefore, not been disturbed. At the base of the chimney, the ceramic pipe is connected to the first length of epoxide pipe by a normal joint.

The epoxide pipes have been produced in ten-foot sections, each weighing about 90 lb.

Overseas News

$30 M. EXPANSION PROGRAMME PLANNED BY OLIN MATHIESON CHEMICAL

OLIN Mathieson Chemical Corp. plan a $30 million expansion in the organic and inorganic chemical fields. Included in the expansion, which is part of a five-year programme, are new facilities at Brandenburg, Kentucky, for the production of glycerine, cellulose film and drugs, and facilities for manufacture of epichlorhydrin, propylene oxide, propylene glycol and polypropylene glycols.

Propylene facilities are expected to be completed by the beginning of next year and the glycerine and epichlorhydrin units early in 1961. Olin Mathieson also plan to expand the Brandenburg facilities to double production of glycol ethers, surfactants and ethylene dichloride.

Glycerine and epichlorhydrin will be produced by a new process developed in Olin Mathieson laboratories. It is thought that demand for these two products will be about 335 million lb. a year in the 1962-1964 period. Current total demand for natural and chemically synthesised glycerine and epichlorhydrin is about 250 million lb.

U.S. Order for Italian Rubber

A large order for foam latex worth several hundred million lire has been placed by U.S. armed forces stationed in Germany with Pirelli-Sapsa of Italy. The latex will be produced at the company's works at Sesto San Giovanni.

Venice-Munich Pipeline

A scheme for the laying of a pipeline for mineral oil with an accompanying 'private autobahn' from Venice to Munich is to be laid before the Austrian Government, across whose territory it would pass, within the next few weeks. The pipeline would carry 3 million tonnes of oil a year. Erection of a refinery in the Innsburck Free Customs Zone is also suggested. Plan for the pipeline is backed by an Italian finance company.

Amoco to Build Plant for Trimellitic Anhydride

Amoco Chemical Corporation, Chicago, U.S., are to start immediately construction of a semi-commercial plant to produce multi-million lb. quantities of trimetallitic anhydride—the first stage in Amoco's plans for full scale commercialisation of the material.

Amoco introduced trimellitic anhydride in development quantities less than a year ago; rapid progress of the project is attributed to the product's advantages in protective coatings, plastics and adhesives. The unusual reactivity offered by the presence of both an anhydride and a free acid group in the chemical structure is said to enable products to be made which cannot be duplicated with currently available materials.

The semi-commercial plant should be on stream by mid-1960. Trimellitic anhydride is the first in a series of new aromatic acids which can be made by the Amoco oxidation process. Pilot plant quantities of other new aromatic acids will be introduced during the next 12 months.

New Salt and Chlorine Plants for Kuwait

Electricity Department, Government of Kuwait, has called for tenders by 14 October for the supply and assembly of salt and chlorine factories. The salt factory should have a daily production, on a 24-hour operating basis, of 10 to 20 tons; and the chlorine plant a daily production on a similar 24-hour basis of 2 to 4 tons.

Swiss Reichhold Company Has Three-Year Expansion Plan

A new three-year expansion programme for Reichhold Chemie A.G., Hausen bei Brugg, Switzerland, is to cost S.Fr.10 million. A new phthalic anhydride plant, with a capacity of 5,000 tons a year, is now under construction and scheduled for production early next year. Reichhold Chemicals Inc., U.S., have three phthalic anhydride plants in the U.S. and others in Canada, Australia, England, West Germany and France.

U.S. Firm Produces Porous Plastics Sheets

Plastics sheets with fine pores are now being produced commercially in the U.S. by ESB-Reeves Corporation at Buena Vista, Va., new affiliate of Electric Storage Battery Co., and Reeves Bros. Corp. Such sheet with controlled uniform microporosity can be used for filtration without filter aids. Also because they can be made permeable to gases but impermeable to liquids, they can be used for 'breathing' rainproof garments.

E.S.B. have a patented process by which microporous p.v.c. battery separators have been made. Almost any thermic plastics can be endowed with pores of defined uniformity and fineness—1 to 10 microns. Softened thermoplastic is mixed with starch of selected particle size (e.g., rice, pores of 1-5 microns; corn starch, 5-10, potato starch 20-30). The mix is extruded, callendered or spread coated to desired shape. Shaped material is plunged into boiling water and each starch particle gels; expands by 40% and ruptures its plastic containing wall. Starch is leached out with sulphuric acid leaving a finely channelled plastics material.

E.S.B.-Reeves are also understood to be investigating sintering plastics on a moving belt under infra-red lamps. In the U.K. Pritchard and Gold and E.P.S. Co. Ltd. are producing porous polythene, having pores of 100-200 microns. Applications for these porous plastics are different from E.S.B.-Reeves type.

U.S. Committee Control General Aniline Shares

A group of New York investors have formed a committee with the name of American Shareholders Committee of General Aniline and Film Corporation, to be responsible for the sale of the corporation's shares. The chairman of the committee, Mr. David H. Green, stated in New York recently that 30,000 of the corporation's 52,000 shares at present in American possession are in the hands of the committee's eight shareholders. Some 97% of the company's shares were confiscated by the U.S. Government during the war under the Enemy Aliens Act.

E. Germans Reach Some Targets, Miss Others

The East German Planning Commission's report on production in the first six months of this year shows that targets were not reached for output of sulphuric acid and calcined soda nor for equipment for the chemical industry. On the other hand, production of potash—which is to go up steeply in the next seven years—was 24,100 tons above the target, and quotas for phosphates, nitrates, carbide and caprolactone, among other substances, were over-fulfilled.

Italian Gasification Process

Centro Studi Elettronica e Telecomunicazioni operated by C.N.R. in Pisa, have developed an apparatus for gasifying liquid hydrocarbons by means of electric discharge. The equipment can produce 0.35 c.m. of gas an hour. Expenditure on electricity totals 1 kW. per 0.2 cm.

New Antioxidant for Tyres

New antioxidant, which prevents rubber cracking effects of ozone and oxygen, is Flexone 3-C. Chemically, N-phenyl-N'-isopropyl phenylendiamine, it has been developed by Naugatuck Chemical Division of U.S. Rubber Co., U.S. According to U.S. Rubber, cracking is prevented by inhibiting the chain reaction of oxygen with rubber and by direct reaction with the ozone present on the tyre surface.

Tests conducted by the company involved exposure and road experiments using tyres made with and without the chemical. Ozone concentrations averaged 16 parts per hundred million units of air (from a few parts to 64 parts). Flexone 3-C treated tyres showed little or no cracking, while the untreated tyres showed marked or severe cracking, it is claimed.

Mexico's Citric Acid Plant

In full production next spring will be Mexico's first fermentation process citric acid plant, reports Stauffer Chemical

Co., 36% owner of Industrias Quimicas de Mexico, who are to build the plant. The plant is expected to be set up near Morelia, some 100 miles west of Mexico City. It will use raw materials from the nearby sugar industry using a process developed by Stauffer.

Capacity of the plant is not revealed; Stauffer say only that it will supply all of Mexico's citric acid needs, most of which is now imported.

Plastics Plant for China

Reported to be under construction at Foochow, in Communist China, is a large-scale plastics plant. First stage of production is scheduled to begin at the end of this year and the second stage next year. The plant is to have an annual production capacity of 6,000 metric tons of polyvinyl chloride and will also produce polyvinyl acetate and plastics, based on furfurol.

New Japanese Carbide Facilities

The two Japanese carbide producers, Nippon Carbide Kogyo K.K., of Notso, and Shin Nippon Chisso Hiryo K.K., of Minimata, have taken over new carbide furnaces with capacities of, respectively 50,000 metric tons and 70,000 metric tons from the Duisberg, West Germany, company of Demag-Elektrometallurgie. According to Japan's last published statistics, carbide production there was some 800,000 metric tons annually. This has now risen by 40% in the last few years.

Monsanto's New Copolymers

Now available from Monsanto Chemicals Inc., U.S., are ethylene-maleic anhydride copolymers. These water-soluble resins can be furnished either as an anhydride, a free acid, or an amide-ammonium salt. Derivatives such as transparent film formers, polymeric liquids, waxy solids, and polyampholytes can be made from the copolymers.

Fertiliser Plant for Ecuador

Fabrica Nacional de Abonos Organicos Completos, established by the Ministry of Development of Ecuador at a cost of some sucres 700,000, is scheduled to start operations next October. Initial output is estimated at 370 quintals (46 kg.) of organic fertilisers per day. The plant will be equipped with fully-automatic machinery of Danish manufacture and is designed to produce organic fertilisers from city refuse. Average cost of such imports amounted to about US.$1 million annually.

Bayer and U.S. Rubber Sign Know-how Agreement

Farbenfabriken Bayer A.G., Leverkuson, have concluded an agreement for an interchange of experience and patents with the United States Rubber Co. It covers additives to improve the qualities and durability of rubber.

East Germany's Two New Chemical Plant Producers

Two new State companies for the production of chemical plant have been formed in East Germany. One of them, VEB Komphette Chemieanlagen, is to supply 400 complete chemical units for some 137 different chemical projects by the East German target year of 1965. The other, VEB Bau- und Montagekombinat Chemie, will come into production next year and by 1965 have produced capital goods in the chemical plant field worth DM (East) 3,500 million (as West-Mark some £300 million).

Bulgaria's Chemical Output

According to the Bulgarian Central Bureau of Statistics production of chemicals in the first quarter of 1959 was 26% above the corresponding period of 1958. Production figures were as follows: nitrate fertilisers, 12,194 tons (6% over 1958); phosphate fertilisers, 7,622 tons (149%); calcinated soda, 28,315 tons (12%); and sulphuric acid, 22,522 tons (51%).

Oil From Coal in Africa

A report is expected shortly on a three-year investigation into the possibility of establishing an oil-from-coal industry near Wankie, Rhodesia. The Rhodesian Anglo-American Corporation and Wankie Colliery are joint sponsors.

Plan to Use Rhodesian Phosphates

A pilot plant, designed to prove that phosphate in the apatite deposits at Darowa, near Inyazura, Southern Rhodesia, can be mined and used in the manufacture of superphosphate, is being constructed by Darowa Minerals Ltd., a subsidiary of African Explosives and Chemical Industries (Rhodesia) Ltd., at a cost of £70,000. If the project, which it is estimated will cost £100,000, is a success, reports Barclays Bank D.C.O., it will no longer be necessary to import phosphate rock from Morocco at a cost of some £700,000 each year.

Also under construction by African Explosives is a new plant to manufacture aluminium sulphate, used for water treatment. At present, about £50,000 a year is spent on imports; production in Rhodesia is expected to start this year.

Another Petro-Chemical Plant for Australia

Petroleum and Chemical Corporation (Aust) Ltd. and Monsanto Chemical Co., St. Louis, U.S., are forming a £A5 million company, Australian Petro-Chemicals Ltd., to build a plant at Silverwater, New South Wales, for the production of styrene, which will be used in polystyrene manufacture.

The plant is expected to go into production in 1961, at the same time as the Altona project announced earlier this year by Australian, U.S. and U.K. interests (C.A., 7 February, p. 247, and 22 August, p. 181).

Columbian Plans for Plastics

Borden Chemical Co., U.S., have announced plans for construction of Colombia's first formaldehyde plant, the recent expansion of an Argentine casein plant and the beginning of polyester resin production in Brazil. These are the first steps in a five-year programme of planned growth in South America.

First Synthetic Rubber from Polish Plant

The first batch of synthetic rubber has been produced at a plant at Oswiecim, which is expected soon to go into regular production.

Fertiliser Projects in East Siberia

TO bring some 16 million acres of land in Eastern Siberia under cultivation by 1965 to 1975 is estimated to require 1.5 million tons of fertiliser (N, P_2O_5, K_2O basis) per year. According to a note in *Khim. Prom* (March 1959, p. 112) the cost of the fertiliser required would be in the region of £167 million. Minimum requirements call for 450,000 tons/year of nitrogen, 470,000 of phosphate (P_2O_5) and 567,000 of potash (K_2O).

Problems associated with agricultural development of Eastern Siberia are the great distance involved between U.S.S.R's present fertiliser plants and the land for development. Transport is limited and distribution costs are likely to equal or outweigh the cost of fertiliser. Hence plans are afoot to manufacture fertiliser locally.

Nitrogen demand can be met from synthetic ammonia plants now in production, under construction or planned. Of the total 450,000 tons N required 25% will be liquid, 25 to 30% mixed or compounded fertilisers, 33% as urea and the remainder, ammonium nitrate.

Phosphate plants are proposed for Bratsk, Krasnoyarsk and Eniseisk, where hydroelectric power stations are situated. Phosphate deposits in the Angara-Ilimsk area, near Bratsk, are not yet fully developed, but raw material is to be imported from Khibinsk and Kara Tau initially. There is plenty of cheap water power and coal for making elemental phosphorus (electric furnace), phosphoric acid and phosphates. According to the plan, each power station is expected to produce 55,000 tons P_2O_5 as double superphosphates, about 44,000 tons of Nitrophoska, and 99,000 tons of basic slag.

The Krasnoyarsk and Bratsk power stations are expected to use Angara-Ilimsk and micaceous phosphorites in due course, plus some imported phosphates. No decisions have been taken with regard to production at Eniseisk, as this is not expected to be on stream before 1970.

Potash production is not expected to start up until 1965 when it is planned to produce 44,000 to 55,000 tons per year as by-product of non-ferrous metallurgy in the form of potassium sulphate from Uzhursk nephelines. Siberia's demand for potash is suggested as 567,000 tons per year.

PEOPLE in the news

● **Dr. J. C. Fidler,** head of the Covent Garden Research Laboratory, received in Copenhagen on 19 August, the first award of the Ottesen Gold Medal for refrigeration research. His work has been on problems of transporting fresh fruit and vegetables. The award was made at the International Refrigeration Congress.

● **Mr. A. K. Sen** has been appointed managing director, and **Mr. P. C. Kavanagh,** assistant managing director, of Indian Oxygen, a subsidiary of British Oxygen Co. Ltd.

● **Dr. L. L. Ross** has been appointed managing director of Elliott Brothers (London), a subsidiary of Elliott-Automation. **Mr. L. Bagrit** will continue to be chairman and chief executive. **Mr. E. O. Herzfeld,** the controller, has, in addition, been appointed deputy managing director; and **Mr. G. C. Fairbanks** and **Cmdr. H. Pasley-Tyler** have been appointed assistant managing directors. **Mr. L. C. Upsdell,** secretary of the company, has joined the board.

● **Mr. James Sheridan,** vice-president and treasurer of Allied Chemical Corporation, New York, was among the passengers who disembarked at Cobh on 21 August from the liner *Mauretania*, which called there on her way from New York to Southampton.

● Constructors John Brown Ltd. have made the following appointments in the Automatic Control Division: **Mr. P. C. Wollen** sales manager, Northern England and Scotland; **Mr. L. S. James** sales manager, Southern England and Midlands; **Mr. H. W. Griffiths** industrial sales manager.

● **Mr. A. M. Wandless,** director of scientific control, and **Mr. H. H. Shaw,** head of productivity and costs branch, are members of a delegation of the National Coal Board at present visiting mines and research establishments in Czechoslovakia.

● **Mr. G. E. Stewart,** manager of the Billingham-on-Tees anhydrite mine of Imperial Chemical Industries Ltd., is to retire and will be succeeded by **Mr. G. E. Pearse,** who has been mine underground manager for three years. Mr. Stewart joined I.C.I. as a mining engineer 33 years ago, and worked on the sinking of the anhydrite mine shafts.

● **Mr. K. J. Mills** of the Southern sales region of the Shell Chemical Co., who has been representing the company in the counties of Beds, Bucks, Oxon, Herts and Berks, has been transferred from the detergent section to the solvent/general chemicals section. His place as detergent representative has been taken by **Mr. E. R. Shepherd.**

● **Mr. W. E. Hoes** has left for Australia to open the new £100,000 factory of Richard Klinger Ltd., at Perth. Mr. Hoes will be managing director of the new company, Richard Klinger (Pty.) Ltd., which will manufacture Klingerit sheet jointing, cut gaskets and other Klinger engineering products.

● **Mr. Walter Garner, F.T.I.,** and **Dr. A. R. Urquhart** have been awarded the Service Medal of the Textile Institute. Mr. Garner, who is a chartered textile consultant, is chairman of the London and district section. Dr. Urquhart is hon. secretary of the institute, and an assistant director of the British Cotton Industry Research Association, in charge of chemistry and chemical finishing.

H. J. Podmore who will manage Birlec's new Midland area sales office. (See 'Trade Notes,' p. 230.)

● **Dr. W. A. Bullen,** 40, has been appointed sales manager of the Boehringer Products Division of Pfizer Ltd., Folkestone, Kent. He will also act as deputy to the general manager, **Mr. W. R. Miller.** The appointment is part of a major reorganisation of the structure of the division following expansion of the sales organisation. Dr. Bullen, who was in practice at Sandwich for five years, joined the company two years ago and was appointed medical director last year. **Dr. F. J. A. Bateman,** 38, succeeds him as director of medical services.

● **Mr. Edward Bentley** has been appointed London branch manager, southern area, for Griffin and George Ltd., Alperton, Middx. **Mr. Kenneth Freer** becomes Manchester branch manager, northern area, with **Mr. James Branson** as assistant manager. **Mr. Douglas Savage** continues as field sales manager, northern area.

● The board of the Imperial Aluminium Co. Ltd., formed in June when I.C.I. and the Aluminium Co. of America agreed to collaborate in the manufacture of wrought aluminium products, has been constituted as follows: from I.C.I.—**Dr. James Taylor** (chairman), **Mr. Berkeley Villiers** (managing director) and **Mr. Michael Clapham;** from Alcoa—**Mr. DuBose Avery** and **Mr. F. J. Resch.** Dr. Taylor has been a member of the main board of I.C.I. since 1952 and is responsible for the metals and explosives activities of the company.

● **Sir Norman Hulbert, M.P.,** is to join the board of Dow Agrochemicals Ltd., the British subsidiary of Dow Chemical Co. of America. The company's £1 million factory is now under construction at King's Lynn, Norfolk.

● **Mr. W. J. Hatchley,** who has been connected with the boron products trade for 38 years and has been managing director of Borax and Chemicals Ltd., 35 Piccadilly, London W.1, since its inception, is relinquishing executive duties but will remain a member of the board. **Mr. G. L. Thompson,** who has also been connected with the company for many years, has been appointed managing director.

W. J. Hatchley **G. L. Thompson**

Obituary

The death occurred on 17 August, of **Mr. R. S. Haskew,** O.B.E., A.C.G.I., F.R.I.C., who founded the General Chemical and Pharmaceutical Co. Ltd., Sudbury, Middlesex, and was its chairman and managing director. He did valuable work in connection with the Department Committee on the Carriage of Dangerous Goods and Explosives in Ships, 1946-51, and subsequently the Ministry of Transport Advisory Committee, and the British Standards Institution and as a member of the council of the Association of British Chemical Manufacturers.

The death has taken place of **Mr. Ernest Pedley,** director of the North-West Forensic Science Laboratory at Preston, aged 43.

Mr. John Goodrich Kay, managing director of Lafarge Aluminous Cement Co. Ltd. since 1948, died recently. He had been a director since the founding of the company in 1923.

Commercial News

• Monsanto Half-year Sales Up £1·2 m.
• A. & W.'s Big Rise in Half-year Profit
• Canadian Du Pont Sales Show Big Rise
• Power-Gas Set up New Plant Company

Monsanto Chemicals

Net sales of £8,726,720 for the first half of 1959 are reported by Monsanto Chemicals Ltd. This is some £1.24 million higher than the £7,489,848 of the corresponding 1958 period. Net income for the six months was £371,611, as against £247,642 for the first half of 1958, after charging estimated taxes of £348,400 against £284,100.

In 1958 net sales were £15,426,633 and net income £629,564, after taxes of £685,385.

A maintained interim of 5% is declared on the £5.4 million ordinary capital. The previous year's total was 13½%.

These figures relate to the company and its U.K. subsidiaries only, and do not include the Australian subsidiary.

Sir Miles Thomas, chairman, reports that the increase in the half year's net sales and in income is an encouraging indication of both greater demand for and output of products. During this six-months period some units of the new polythene plant at Fawley came on-stream as scheduled, and the on-stream time is stated as continuing to increase. Results are mainly due, however, to increased business done and improved efficiency in the manufacture of previously established products. Export sales accounted for 37% of trade.

The improved trend of business in the first half of this year has continued.

Albright and Wilson

Trading profit of Albright and Wilson for the first half of 1959 was £3,328,000 (£2,453,000). Group net profit for the half year was £1,122,000 (£793,000); tax took £1,103,000—only £439,000 below the 1958 total—against £749,000. The increase in profits resulted mainly from higher sales at home and overseas and partly from expanded production facilities which came into operation in mid-1958. Improvements in efficiencies also made an important contribution. Present indications are that profits for the remainder of 1959 may be slightly lower than for the first half of the year.

An interim of 6% is announced (4%, equivalent to 5% in 1957). The board is to issue one fully paid ordinary unit for every four units held on 4 September. Both increases are intended as 'technical adjustments'; the first to make the interim a high proportion of the total distribution and the second, to reduce disparity between the issued capital and the total shareholders' funds employed in the company. Neither individually nor taken together do they imply an increase in the total distribution for the year.

Unilever

Combined turnover of Unilever Ltd. and Unilever N.V. for the first half of 1959 is estimated at £861 million (£860 million). After tax of £26.4 million (£22.3 million), combined profit was £27.4 million (£20.9 million), comprising £13 million (£10.2 million) for Unilever Ltd. and £14.4 million (£10.7 million) for Unilever N.V. Consolidated net profit was £29.8 million (£20.3 million).

Celanese Corporation

Net income of the Celanese Corporation of America for the six months ended 30 June was $10,445,088 ($5,701,345). Sales were valued at $127,578,050 ($103,787,203).

Olin Mathieson

Sales by Olin Mathieson Chemical Corporation, U.S., at $347 million, showed a 26% gain for the first six months of 1959 compared with sales of $275.6 million in the same period of 1958. Net profits increased 79% to $17.5 million from $9.8 million in the comparable period last year.

Du Pont of Canada

Du Pont of Canada announce sales of $44,523,000 for the first half of 1959, 11% above the corresponding period of last year. The volume of sales of most products improved, aided by shipments from recent additions to plant capacity. Net income for the period of $3,665,000 was above the first six months of 1958. The greater volume of production at the newer plants and the efficiencies obtained as a result of process and equipment changes have also contributed to the improvement in the profits. However, preliminary manufacturing costs and expenses will be incurred at the polythene resins plant in the second half of 1959.

Charges for depreciation are up 12% due to increased investment; interest on short-term borrowing was about 21% higher than a year ago. After allowing for the increased income tax rate applicable for the full year 1959, the total tax provision was double that of a year ago.

Costs and expenses amounted to $33,703,000 ($33,010,000).

NEW COMPANIES

P. G. Engineering Ltd. Cap.: £100,000. Designers, manufacturers and constructors of plant and equipment for the production and treatment of chemicals, gases, oils, metals, minerals, etc. Directors: C. Robson, R. Brown, C. E. Wrangham, R. W. Rutherford, P. M. K. Embling, C. Ingman and T. H. Riley. So long as the Power-Gas Corporation Ltd. hold 95% of the issued shares they will appoint and remove the directors.

Technicon Chemicals Ltd. Cap. £100. To design, build and equip chemical, metallurgical and gas plants, to manufacture chemicals and chemical materials for use in chemical plants, etc. Reg. office: 115 Leadenhall Street, London E.C.3.

INCREASE OF CAPITAL

Benger Laboratories Ltd., manufacturing chemists, etc., London Road, Holmes Chapel, Ches. Increased by £569,900, beyond the registered capital of £100.

Market Reports

GOOD FLOW OF NEW BUSINESS

LONDON The movement against contracts to home consumers has, in the aggregate, covered good volumes, and the flow of new business for industrial chemicals has been fairly good for the period.

Dichromates and chlorate of soda are in active request, while demand for the barium compounds is well maintained. The market for fertilisers is seasonally dull. Sulphate of copper and the zinc oxides are in good call at the higher prices now ruling. The price position generally is steady with a firm undertone. Conditions on the coal-tar products market show little change.

MANCHESTER There is still room for improvement in the demand for textile chemicals, but most other industrial consumers have taken reasonably good deliveries against contracts and there has been a fair number of fresh enquiries. Exports are satisfactory and most outlets are absorbing bigger quantities over a wide range of products. Prices are steady to firm. Most sections of the fertiliser market are seasonably quiet; there is a fair home and export movement in some of the leading tar products.

SCOTLAND With the completion now of most of the holiday periods the Scottish heavy chemical market during the past week has returned to more or less normal trading conditions.

Business has been brisk with, as usual, demands both against spot and contract requirements well maintained. Quantities have been steady and have covered a varied range of chemicals. Prices have shown some slight variation but on the whole continue fairly firm.

Agricultural chemicals have been rather quieter with a tendency to those fertilisers for nominal requirements. There is still a volume of enquiries for the overseas market.

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PRODUCTS OF I.C.I. HEAVY ORGANIC CHEMICALS DIVISION

Full information on request

IMPERIAL CHEMICAL INDUSTRIES LIMITED

LONDON, S.W.1.

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Company Meeting

THE DISTILLERS COMPANY LIMITED

The 82nd Annual General Meeting of The Distillers Company Limited will be held in the North British Hotel, Edinburgh, on Friday the 11th day of September 1959, at 12.15 p.m. The following are excerpts from the statement by the Chairman, Sir Graham Hayman, which has been circulated with the Report and Accounts for the year ended 31st March 1959.

The trading profit of the Group after depreciation amounted to £24,829,402, an increase of more than £2,000,000 compared with last year. Income from trade investments was also higher at £1,807,184, mainly owing to an increased dividend from Murgatroyd's Salt & Chemical Company Ltd. After charging interest on loans, the consolidated profit was £25,947,701, compared with £23,463,856 last year.

Taxation requires £12,581,361, and the amount attributable to minority interests in Subsidiaries is £194,245, so that the net profit attributable to the Distillers Company is £13,172,095. Of this, Subsidiaries have retained £3,876,448, and, after minor adjustments, the amount available for appropriation is £9,165,727.

As foreshadowed last year, the Company capitalised a substantial part of its reserves immediately after declaration of the interim dividend, and the rate of 7½% declared on the old capital is equivalent to 4% on the revised capital. Your directors recommend that a final dividend at the rate of 8½% be declared, making 12½% for the year on the revised capital. If this recommendation is accepted, the total amount required for the purpose of dividends will be £5,990,182, and the profits retained by the Distillers Company itself will be £3,175,545. Your Directors have transferred £3,238,801 to general reserve, thus slightly reducing the amount brought forward on the appropriation account.

Scotch Whisky

Our distilleries, both Malt and Grain, have been in full operation throughout the season. These production units are being maintained at a high level of efficiency. Extensive additions to our widespread warehouse accommodation are being undertaken to accommodate our increasing stocks, and the progressive overhaul and modernisation of our blending and bottling establishments have continued throughout the year.

With regard to the home market, as is well known, our Scotch Whisky Companies have been obliged to ration supplies for many years. I am now very glad to report that as from 1st April 1959, we have at last been able to release customers from the quota system on Standard brands, and I hope that by the end of this year our shareholders and the public in general will be able to obtain any of our Standard brands.

Turning now to export markets, our shipments to the United States have again shown a substantial increase. While our distributors are confident of maintaining the sales of our brands in that market, it seems clear that additional sales in future will be increasingly hard to achieve.

In general, although we consider the outlook for increased sales is reasonably encouraging, it is clear that we are moving into a phase where selling will become increasingly competitive. I believe our organisation is well equipped to meet these conditions.

Gin

The total sales of our Gin Companies in the home market showed a modest increase over the previous year. More competition is developing by the introduction of new brands and by increased sales promotion of others. In these circumstances, it is gratifying that our own brands have not only maintained, but have improved their position. We believe that with a forceful selling policy and the continuance of the high standard of quality familiar to the public, we shall continue to make progress in this market.

Export markets are becoming more difficult, but in those areas where our brands can be imported without restriction, our shipments have been satisfactory.

Industrial Group

As a result of the recession in industrial activity in this country and abroad, trading conditions in our Industrial Group were difficult throughout the year. Since the end of the period under review, however, there has been an appreciable improvement in demand, although competition is likely to keep prices to the lower levels of the past year. This cannot be regarded as a temporary phase, and the only effective remedy is further improvement in production techniques and the increased volume which we hope to achieve.

Chemical Division

Despite the more difficult times through which some of the industries served by this Division have been passing, the volume of sales, in general, has been maintained at home and in the export markets. Keen competition was encountered, especially overseas, which caused reductions in selling prices.

Due to the continued high cost of molasses it was decided to cease production of acetone and butyl alcohol by fermentation of this raw material. Certain of the manufacturing operations are being re-established using petroleum based raw materials.

The volume of sales of Carbon Dioxide was maintained in spite of the adverse weather conditions during last summer. Calcium Carbide sales had a setback from the record figures of last year, but demand revived during the early part of 1959, and now seems likely to continue at a high level.

Good progress was made with the construction of a large new plasticisers plant at Hull, part of which is already in commission. The main product from this plant will be phthalates of the high quality required by the plastics industry. This plant employs a continuous system of esterification invented by our own technicians. The results obtained by an overseas licensee confirm that this will be a highly efficient method.

British Hydrocarbon Chemicals Ltd.

This company and its subsidiaries, Forth Chemicals Limited and Grange Chemicals Limited, again had a good year, with a further improvement in earnings.

The new plant to make "Rigidex," the high density polyethylene, which should have been completed in April, has, unfortunately, been delayed by a number of circumstances including unofficial strikes by our Contractors' employees. It is now being commissioned and, in the meantime, we have imported supplies of "Rigidex." This new material has been well received in the plastics industry, and will facilitate our sales development.

The construction of the new Phenol plant, which incorporates our own process, has made good progress; it is expected to start up towards the end of 1959.

Last autumn, the Secretary of State for Scotland attended a ceremony to mark the commencement of construction of our third cracker. The new plant, which is due for completion by 1960, will have a capacity of some 70,000 tons of ethylene per annum and will be the largest producer outside the U.S.A. When these projects are completed, the total investment by British Hydrocarbon Chemicals Limited, in which The Distillers Company Limited and The British Petroleum Company Limited have equal shares, will amount to over £30 m.

Plastics Division

The slight recession experienced by many sections of the plastics industry in the early months of last year gave way to a marked improvement in de-

Company Meeting Cont'd

mand, with the result that our sales for the year were in excess of those of the previous year, and we have maintained our position in home and overseas markets. Foreign competition was active, however, resulting in lower prices, which narrowed profit margins.

Further expansion in productive capacities has been authorised to meet the anticipated growth in demand for our materials for new industrial applications. In this connection, our Consumer Research Laboratories continue to make valuable contributions.

Biochemical Division

Although competition both at home and abroad was keener than ever, our volume of sales was higher than last year. Earnings were reasonably satisfactory, but the prices of antibiotics in export markets have reached uneconomic levels. Marked improvements have been achieved in our technical operations resulting in lower costs, which is enabling us to meet competition.

Last year we formed an Australian subsidiary, The Distillers Company Biochemicals (Australia Pty.) Limited, to facilitate our expanding operations in the Australian Continent. The trading results to date have been encouraging.

During the year, we introduced a new product under the brand name 'Distaval," which is a completely safe, non-toxic sedative. This has been well received by the medical profession, and sales are developing very satisfactorily.

Food Division

Yeast. Sales of Yeast were on a satisfactory level; the decline in consumption to which I have referred on previous occasions was much less marked and we appear to have reached a degree of stabilisation in the home market.

Technical Development

The increasingly competitive conditions which must be expected within British industry and from overseas gives added significance to the work carried out by the staffs of our various technical departments, and I am glad to record that the efforts of those concerned continue to play a vital part in the economy of the organisation as a whole. The appropriation for our Research, Development and Engineering Departments for the year under review was approximately £2 m.

Personnel

The year under review has not been an easy one, but the excellent results which your Group has achieved have been made possible by the combined and sustained efforts of all its employees. To all members of our organisation, both at home and abroad, I would like to express the sincere thanks of the Board.

TRADE NOTES

Indicator in New Size

Perkis, Williams Ltd., 60 Brewery Road, London N.7, are making available their indicator,Thyodene, in an additional standard packing, in a 250 gm. bottle at 22s 6d inclusive of packing and postage. Thyodene will still be available in 100 gm. bottles at 9s 6d a bottle.

Heat-Resistant Conveyor Belt

Star-hete, a new synthetic rubber conveyor belt constructed to handle hot and abrasive materials, has been developed by Dunlop for use in the chemical, cement, gas and iron and steel industries. Star-hete has a cover of synthetic rubber which will withstand temperatures of up to 350°F, and can be supplied with a carcase weight of duck, and in ply ratings, to suit all conditions and loads. Customer inquiries should be addressed to Dunlop Rubber Co. Ltd., Belting Division, Speke, Liverpool 24.

Moorhouse Agency

Guest Industrials Ltd., London, have given up their agency for Morehouse International, Los Angeles, in favour of Durham Raw Materials Ltd., 1-4 Great Tower Street, London E.C.4. The agency covers the sale of Morehouse Mills and Cowles dissolvers.

Cruikshank-Iridite Agreement

Under a new agreement, R. Cruickshank Ltd., chemical manufacturers and metal finishing specialists, Camden Street, Birmingham, have been granted exclusive licence for the manufacture and sale in the U.K. of a wide range of Iridite products of Allied Research Products Inc., Baltimore, Maryland, U.S. These products are for use in metal corrosion prevention processes. The licence also covers their sale in certain countries overseas; licence to use the Iridite trade mark has also been granted.

Data Book on Cellobond Resins

A new data book describing their range of Cellobond adhesive and binder resins has been published by British Resin Products Ltd., Devonshire House, Piccadilly, London W.1.

Change of Address

Anglo-American Plastics Ltd. (one of the Commercial Plastics Group), extruders and converters of Fablothene polythene sheet film, layflat tubing and bags, have moved to larger premises at 45-47 Wigmore Street, London, W.1 (Welbeck 4171).

Birlec Midland Office

From 1 September, Birlec Ltd., Erdington, Birmingham 24, will establish a Midland area sales office with Mr. H. J. Podmore as manager. The new office will be situated at the company's main premises in Tyburn Road, Birmingham 24. Mr. Podmore joined Birlec in April 1955 as sales manager, Dryer and Gas Plant Division.

Catalysed Coatings

A range of cold setting catalysed coatings for a wide variety of industrial uses is now being marketed overseas by Jenson and Nicholson Ltd., Stratford, London. These coatings dry effectively at temperatures down to 50° F. (10° C.) and at temperatures down to this level they will be touch dry within 90 minutes and hard dry within eight hours. These air-drying coatings are epoxy resin based and are sold under the name Epilac catalysed coatings.

Abril Speciality Waxes

Wax technical service bulletin 62, available from Bush, Beach and Gent Ltd., Marlow House, Lloyd's Avenue, London E.C.3, deals with the Abril speciality waxes, Abril S and Abril IODS. A new emulsifiable micro crystalline wax, No. 736, can be used in dry-bright polishes. With a melting point of 80-82°C, it has an acid value of 24, saponification value of 82 and penetration (100 g./20°C/5 sec) of 17.

Cuprous Chloride Powder

Cuprous chloride conforming to the following average specification—Copper (Cu), 63%; iron Fe (0.004%); insoluble in HCl 0.08%; and cupric chloride ($CuCl_2$) 2.0%—is now being produced by Metallurgical Chemists Ltd., Gresham House, 24 Old Broad Street, London E.C.2. Main uses indicated by Metallurgical Chemists are: catalyst for acrylonitrile synthesis; raw material in synthesis of copper phthalocyanine pigments; and raw material in plastics materials.

Baldwin Industrial Controls

Baldwin Industrial Controls is the new name of Baldwin Instrument Co. Ltd., Dartford, Kent. They offer a range of nucleonic thickness and control gauges which they claim to be the largest in the world. This venture and the development of a Fluid Power Division have widened their activities, making a change of name desirable.

Agreement on Valves

Cockburns Ltd., Cardonald, Glasgow, have concluded an agreement with Black, Sivalls and Bryson, Inc., Kansas City, U.S., to manufacture under licence their Super 70 series of control valves and associated equipment. The full range of these valves and controls will be manufactured by Cockburns in Glasgow and by their subsidiary, Cockburns (Nederland) N.V., in Schiedam, Holland. Flow coefficients have been thoroughly laboratory tested.

Titan Centrifugal Separator

Ferguson and Timpson Ltd., 74 York Street, Glasgow C.2, state that the CNS 150 Superjector, the largest self-cleaning centrifugal separator in the Titan range, is now available in the U.K. This machine has been under development in Denmark for several years, and the design incorporates a number of technical improvements. The installation of a machine of this type, which has a nominal 20 tons/hour capacity, can result in economies in piping, space occupied and attendant labour. Also available is a type designed for the discharge of foamless liquid under pressure.

BRITISH CHEMICAL PRICES

GENERAL CHEMICALS

Acetic Acid. D/d in ret. barrels (tech. acid barrels free); in glass carboys, £8; demijohns, £12 extra. 80% tech., 10 tons, £97; 80% pure, 10 tons, £103; commercial glacial, 10 tons, £106.

Acetic Anhydride. Ton lots d/d, £128.

Alum. Ground, f.o.r., about £25.
MANCHESTER: Ground, £25.

Aluminium Sulphate. Ex-works, d/d, £15 10s to £18.
MANCHESTER: £16 to £18.

Ammonia, Anhydrous. Per lb., 1s 9d-2s 3d.

Ammonium Chloride. Per ton lot, in non-ret. pack, £33 2s 6d.

Ammonium Nitrate. D/d, 4-ton lots, £31.

Ammonium Persulphate. Per cwt., in 1-cwt. lots, d/d, £6 13s 6d; per ton, in min. 1-ton lots, d/d, £123 10s.

Ammonium Phosphate. Mono-and di-, ton lots, d/d, £106 and £97 10s.

Antimony Sulphide. Per lb., d/d UK in min. 1-ton lots: crimson, 5s d/d to 5s 5½d; golden, 3s 3½d d/d per lb. to 4s 8½d d/d.

Arsenic. Ex-store, £45 to £50.

Barium Carbonate. Precip., d/d, 5-ton lots or more, bag packing, £37 10s.

Barium Chloride. 2-ton lots, £46.

Barium Sulphate [Dry Blanc Fixe]. Precip. 2-ton lots, d/d, £39.

Bleaching Powder. Ret. casks, c.p. station, in 4-ton lots. £30 7s 6d.

Borax. Ton lots, in hessian sacks, c.p. Tech. anhydrous, £70; gran., £47; crystal, £50 10s; powder, £51 10s; extra fine powder, £51 10s; BP, gran., £56 10s; crystal, £59 10s; powder, £60 10s; extra fine powder, £61 10s. Most grades in 6-ply paper bags £1 less.

Boric Acid. Ton lots, in hessian sacks, c.p. Comm., gran., £78; crystal, £87; powder, £84 10s; extra fine powder, £86 10s; BP gran., £91; crystal, £84 10s; powder, £91; extra fine powder, £98 10s. Most grades in 6-ply paper bags, £1 less.

Calcium Chloride. Ton lots, in non-ret. pack; solid and flake, about £15.

Chlorine, Liquid. In ret. 16-17 cwt. drums d/d in 3-drum lots, £41.

Chromic Acid. Less 2½%, d/d UK, in 1-ton lots, per lb., 2s 2¼d.

Chromium Sulphate, Basic. Crystals, d/d, per lb., 8½d; per ton, £79 6s 8d.

Citric Acid. In kegs, 1-cwt. lots, per cwt., £11 5s, 5 cwt. lots, per cwt., £11; packed in jute bags or five ply paper bags, both with polythene liners, 5 cwt. lots up, per cwt., £10 12s; 1-4 cwt. lots per cwt., £10 17s.

Cobalt Oxide. Black, per lb., d/d, bulk quantities, 13s 2d.

Copper Carbonate. Per lb., 2s 2d.

Copper Sulphate. F.o.b., less 2% in 2-cwt. bags, £76.

Cream of Tartar. 100%, per cwt., about £11 12s.

Formaldehyde. In casks, d/d, £40

Formic Acid. 85%, in 4-ton lots, c.p., £91.

Glycerine. Chem. pure, double distilled 1.2627 s.g., per cwt., in 5-cwt. drums for annual purchases of over 5-ton lots and under 25 tons, £12 1s 6d. Refined technical grade industrial, 5s per cwt. less than chem. pure.

Hydrochloric Acid. Spot, per carboy, d/d (according to purity, strength and locality), about 12s.

Hydrofluoric Acid. 60%, per lb., about 1s 2d.

Hydrogen Peroxide. Carboys extra and ret. 27.5% wt., £119 0s 0d; 35% wt., d/d, £143.

Iodine. Resublimed BP, under 1 cwt., per lb., 11s; for 1-cwt. lots, per lb., 10s 6d.

These prices are checked with the manufacturers, but in many cases there are variations according to quality, quantity, place of delivery, etc. Abbreviations: d/d, delivered; c.p., carriage paid; ret., returnable; non-ret. pack., non-returnable packaging; tech., technical; comm., commercial; gran., granular.

All prices per ton unless otherwise stated

Iodoform. Under 1 cwt., per lb., £1 2s 4d, for 1-cwt. lots, per lb., £1 1s 8d, 5 cwt., per lb., 21s 1d, crystals, 3s more.

Lactic Acid. Pale tech., 44% by wt., per lb., 14d; dark tech., 44% by wt., per lb., 9d; chem. quality, 44% by wt., per lb., 12¼d; 1-ton lots, ex-works, usual container terms.

Lead Acetate. White, about £154.

Lead Nitrate. 1-ton lots, about £135.

Lead, Red. Basis prices: Genuine dry red, £104 15s; orange lead, £116 15s. Ground in oil: red, £125 5s, orange, £137 5s.

Lead, White. Basis prices: Dry English in 5-cwt. casks, £116 15s; Ground in oil: English, 1-cwt. lots, per ton, £135 15s.

Lime Acetate. Brown, ton lots, d/d, £40; grey, 80-82%, ton lots, d/d, £45.

Litharge. In 5-ton lots, £106 15s.

Magnesite. Calcined, in bags, ex-works, about £21.

Magnesium Carbonate. Light, comm., d/d, 2-ton lots, £84 10s under 2 tons, £97.

Magnesium Chloride. Solid (ex-wharf), £17 10s.

Magnesium Oxide. Light, comm., d/d, under 1-ton lots, £245.

Magnesium Sulphate. Crystals, £16.

Mercuric Chloride. Tech. powder, per lb., for 5-cwt. lots, in 28-lb. parcels, £1 1s 9d; smaller quantities dearer.

Mercury Sulphide, Red. 5-cwt. lots in 28-lb. parcels, per lb., £1 10s. 6d.

Nickel Sulphate. D/d, buyers UK, nominal, £170.

Nitric Acid. 80° Tw., £35 2s.

Oxalic Acid. Home manufacture, min. 4-ton lots, in 5-cwt. casks, c.p., about £133.

Phosphoric Acid. Tech. (s.g. 1.700) ton lots, c.p., £100; BP (s.g. 1.750), ton lots, c.p., per lb., 1s 4d.

Potash, Caustic. Solid, 1-ton lots, £95 10s; liquid, £36 15s.

Potassium Carbonate. Calcined, 96/98%, 1-ton lots, ex-store, about £76.

Potassium Chloride. Industrial, 96%, 1-ton lots, about £24.

Potassium Dichromate. Gran., per lb., in 5-cwt. to 1-ton lots, d/d UK, 1s 2¼d.

Potassium Iodide. BP, under 1-cwt., per lb., 6s 10d; per lb. for 1-cwt. lots, 7s 3d.

Potassium Nitrate. 4-ton lots, in non-ret. pack, c.p., £63 10s.

Potassium Permanganate. BP, 1-cwt. lots, per lb., 1s 11¼d; 3-cwt. lots, per lb., 1s 10¾d; 5-cwt. lots, per lb., 1s 10¼d; 1-ton lots, per lb., 1s 10d; 5-ton lots, per lb., 1s 9½d. Tech., 5-cwt. in 1-cwt. drums, per cwt., £9 15s 6d; 1-cwt. lots, £10 4s 6d.

Salammoniac. Ton lot, in non-ret. pack, £47 10s.

Salicylic Acid. MANCHESTER: Tech., d/d, per lb., 2s 6d, cwt. lots.

Soda Ash. 58% ex-depot or d/d, London station, 1-ton lots, about £16 11s 6d.

Soda, Caustic. Solid 76/77%: spot, d/d 1-ton lots, £33 16s 6d.

Sodium Acetate. Comm. crystals, d/d, £75 8s.

Sodium Bicarbonate. Ton lot, in non-ret, pack, £21 10s.

Sodium Bisulphite. Powder, 60/62%, d/d 2-ton lots for home trade, £46 2s 6d.

Sodium Carbonate Monohydrate. Ton lot, in non-ret. pack, c.p., £64.

Sodium Chlorate. 1-cwt. drums, c.p. station, in 4-ton lots, about £88 10s.

Sodium Cyanide. 96/98%, ton lot in 1-cwt. drums, £126.

Sodium Dichromate. Gran. Crystals per lb., 1s. Net d/d UK, anhydrous, per lb., 1s 1¾d. Net. del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride. D/d, 1-ton lots and over, per cwt., £5; 1-cwt. lots, per cwt., £5 10s.

Sodium Hyposulphite. Pea crystals, £38; comm., 1-ton lots, c.p., £34 15s.

Sodium Iodide. BP, under 1 cwt., per lb., 10s; 1-cwt. lots, per lb., 9s 9d.

Sodium Metaphosphate [Calgon]. Flaked, paper sacks, £133.

Sodium Metasilicate. (Spot prices) D/d UK in 1-ton lots, 1-cwt. free paper bags, £29.

Sodium Nitrate. Chilean refined gran. over 98%, 6-ton lots, d/d c.p., per ton £29.

Sodium Nitrite. 4-ton lots, £32.

Sodium Perborate. (10%0) in 1-cwt. free kegs, cwt. lots, £129 10s.

Sodium Percarbonate. 12½% available oxygen, in 1-cwt. kegs, £170 15s.

Sodium Phosphate. D/d, ton lots: di-sodium, crystalline, £40 10s, anhydrous, £88; tri-sodium, crystalline, £39 10s, anhydrous, £86.

Sodium Silicate. (Spot prices) 75-84° Tw. Lancs and Ches., 6-ton lots, d/d station in loaned drums, £12 10s; Dorset, Somerset and Devon, per ton extra, £3 5s; Scotland and S. Wales, extra, £2 17s 6d. Elsewhere in England, not Cornwall, extra, £1.

Sodium Sulphate [Desiccated Glauber's Salt]. D/d in bags, about £19.

Sodium Sulphate [Glauber's Salt]. D/d, up to £14.

Sodium Sulphate [Salt Cake]. Unground, d/d station in bulk, £10.
MANCHESTER: d/d station, £10 10s.

Sodium Sulphide. Solid, 60/62%, spot, d/d, in drums in 1-ton lots, £36 2s 6d; broken, d/d, in drums in 1-ton lots, £37 2s 6d.

Sodium Sulphite. Anhydrous, £71 10s; comm., d/d station in bags, £27-£28 10s.

Sulphur. 4 tons or more, ground, according to fineness, £20-£22.

Sulphuric Acid. Net, naked at works, 168° Tw. according to quality, £10-£11 12s 6d; 140° Tw., arsenic free, £8 7s 6d; 140° Tw., arsenious, £8 2s 6d.

Tartaric Acid. Per cwt.: 10 cwt. or more, in kegs, 300s; in bags, 292s per cwt.

Titanium Oxide. Standard grade comm., rutile structure, £178; standard grade comm., anatase structure, £163.

Zinc Oxide. Max. for 2-ton lots, d/d, white seal, £106; green seal, £104; red seal, £101.

SOLVENTS AND PLASTICISERS

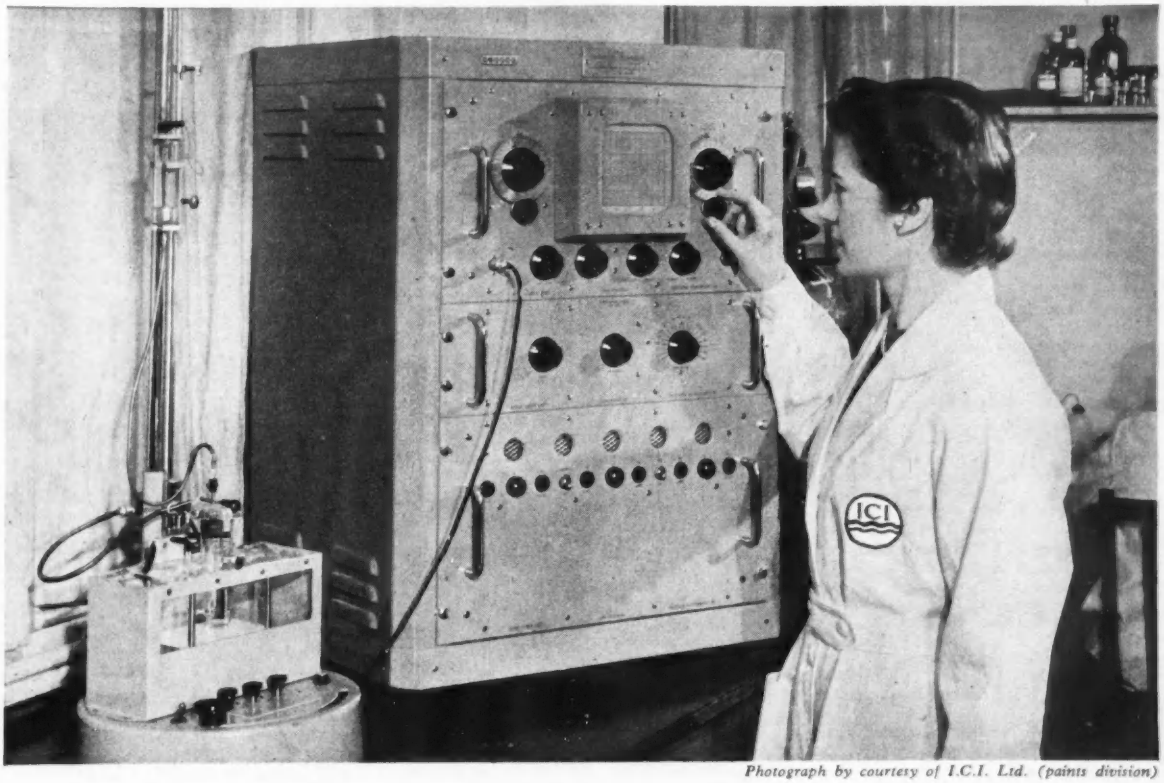
Acetone. All d/d. In 5-gal. drums, £128; in 10-gal. drums, £118; in 40-45 gal. drums, under 1 ton, £93; 1-5 tons, £90; 5-10 tons, £89; 10 tons and up, £88; in 400-gal. tank wagons, £85.

Butyl Acetate BSS. 10-ton lots, £173.

***n*-Butyl Alcohol BSS.** 10 tons, in drums, d/d, £149.

***sec*-Butyl Alcohol.** All d/d. In 5-gal. drums, £168; in 10-gal. drums, £158; in 40-45 gal. drums, under 1 ton, £133; 1-5 tons, £130; 5-10 tons, £129; 10 tons and up, £128; in 400-gal. tank wagons, £125.

This is polarography — the easy way!



Photograph by courtesy of I.C.I. Ltd. (paints division)

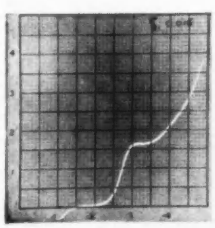
Analysts all over the world have found how easy it is to get rapid and accurate analyses with our Cathode Ray Polarograph. It is quick in action, gives direct or derivative readings, and has that extra sensitivity you so often require.

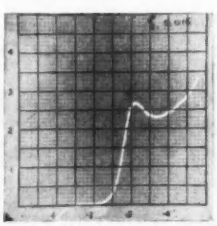
Its easily readable peak polarograms repeat every seven seconds. Your laboratory is wasting expensive time without this indispensable instrument.

SPECIFICATION

DISPLAY. six-inch diameter cathode ray tube, with a 9cm. square graticule printed on its flat, long persistence screen.

VOLTAGE SWEEP. Rate: 0.3 volt per second (fixed). Range: 0.5 volt per sweep approximately (fixed). Start Potential: + 0.5 volt to -2.0 volts (variable). Sweep Time : One polarogram per mercury drop with seven second repetition.





TYPICAL APPLICATION FOR CATHODE RAY POLAROGRAPH

Determination of Pb in Citric Acid (Analar Specification — not above 0.0002 per cent Pb). Introduce 2 g of sample into 10 ml flask. Add 0.2 g ascorbic acid, made up with deionised water and shake. Transfer 5 ml to polarograph cell and read peak height (shown in Plate 1).

Then add to cell 0.01 ml standard Pb solution (50 µg/ml). Mix and read peak height (plate 2).

Calculation :

x g Pb + 0.5 µg/pb = 27
x g Pb = 17
∴ 0.5 µg Pb = 10
x = 0.85 µg
or approximately 1 p.p.m.

SOUTHERN INSTRUMENTS

REPLY TO THE ANALYTICAL INSTRUMENTS DEPARTMENT SOUTHERN INSTRUMENTS LTD. CAMBERLEY SURREY ENGLAND. CAMBERLEY 3401

***tert*-Butyl Alcohol.** 5-gal. drums, £195 10s; 40/45-gal. drums: 1 ton, £175 10s; 1-5 tons, £174 10s; 5-10 tons, £173 10s; 10 tons and up, £172 10s.
Diacetone Alcohol. Small lots: 5-gal. drums, £185; 10-gal. drums, £175. 40/45-gal. drums: under 1 ton, £148; 1-5 tons, £147; 5-10 tons, £146; 10 tons and over, £145, in 400 gal. tank wagons, £142.
Dibutyl Phthalate. In drums, 10 tons, d/d, per ton, £210; 45-gal. drums, d/d, 1-4 drums, £216.
Diethyl Phthalate. In drums, 10 tons, per ton, £187 10s; 45-gal. drums, d/d, 1-4 drums, £193 10s.
Dimethyl Phthalate. In drums, 10 tons, per ton, d/d, £179, 45-gal. drums, d/d, 1-4 drums £185.
Dioctyl Phthalate. In drums, 10 tons, d/d, per ton £284; 45-gal. drums, d/d, 1-4 drums £290.
Ether BSS. 1-ton lots, drums extra, per lb., 1s 11d.
Ethyl Acetate. 10-ton lots, d/d, £145.
Ethyl Alcohol [PB 66 o.p.]. Over 300,000 p. gal. 4s 0½d; d/d in tankers, 2,500-10,000 p. gal. per p. gal., 4s 2½d. D/d in 40/45-gal. drums, p.p.g. extra, 1d.
Absolute alcohol (75.2 o.p.), p.p.g. extra, 5d.
Methanol. Pure synthetic, d/d, £43 15s.
Methylated Spirit. Industrial 66° o.p.: 500-gal. and up, d/d in tankers, per gal., 5s 10½d; 100-499 gal. in drums, d/d, per gal., 6s 3d-6s 5d. Pyridinised 66° o.p.: 500 gal. and up, in tankers, d/d, per gal., 6s 2d; 100-499 gal. in drums, d/d, pet gal., 6s 6½d-6s 8½d.
Methyl Ethyl Ketone. All d/d. In 5-gal. drums, £183; in 10-gal. drums, £173; in 40/45-gal. drums, under 1 ton, £148; 1-5 tons, £145; 5-10 tons, £144; 10 tons and up, £143; in 400-gal. tank wagons, £140.
Methyl *iso*Butyl Carbinol. All d/d. In 5-gal. drums, £203; in 10-gal. drums, £193; 40-45 gal. drums, less than 1 ton, £168; 1-9 tons, £165; 10 tons and over, £163; in 400-gal. tank wagons, £160.
Methyl *iso*Butyl Ketone. All d/d. In 5-gal. drums, £209; in 10-gal. drums, £199; in 40/45-gal. drums, under 1 ton, £174; 1-5 tons, £171; 5-10 tons, £170; 10 tons and up, £169; in 400-gal. tank wagons, £166.
***iso*Propyl Acetate.** In drums, 10 tons, d/d, £137; 45-gal. drums, d/d, £143.
***iso*Propyl Alcohol.** Small lots: 5-gal. drums, £118; 10-gal. drums, £108; 40/45-gal. drums: less than 1 ton, £83; 1-9 tons, £81; 10-50 tons, £80 10s; 50 tons and up, £80.

RUBBER CHEMICALS

Carbon Disulphide. According to quality, £61-£67.
Carbon Black. 7¼d per lb. ex-works Swansea, 3 ton lots and over, under 3 tons but not less than 1 ton 7¾d per lb. ex-works, ex-store, London and Manchester, 8¼d per lb.
Carbon Tetrachloride. Ton lots, £83 15s.
India-Rubber Substitutes. White, per lb., 1s 5¾d to 1s 8d; dark, d/d, per lb., 1s 1¼d-1s 5d.
Lithopone. 30%, about £55 10s. for 5 ton lots.
Mineral Black. £7 10s-£10.
Sulphur Chloride. British, about £50.
Vegetable Lamp Black. 2-ton lots, £64 8s.
Vermilion. Pale or deep, 7-lb. lots, per lb., 15s 6d.

COAL TAR PRODUCTS

Benzole. Per gal., min. 200 gal., d/d in bulk, 90's, 5s. 3d; pure, 5s 7d.
Carbolic Acid. Crystals, min. price, d/d bulk, per lb., 1s 4d; 40/50-gal. ret. drums extra, per lb., ¼d. Crude, 60's, per gal., 8s 4d..
MANCHESTER: Crystals, d/d, per lb., 1s 4d-1s 7d; crude, naked, at works, 8s 5d.
Creosote. Home trade, per gal., according to quality, f.o.r. maker's works, 1s-1s 9d.
MANCHESTER: Per gal., 1s 2d-1s 8d.
Cresylic Acid. Pale 99/100%, per gal., 6s 8d. D/d UK in bulk: Pale ADF, per imperial gallon f.o.b. UK, 7s 3d per US gallon, c.i.f. NY, 95 cents freight equalised.
Naphtha. Solvent, 90/160°, per gal., 5s. 1d; heavy, 90/190°, for bulk 1,000-gal. lots, d/d, per gal., 3s 11d. Drums extra; higher prices for smaller lots.
Naphthalene. Crude, 4-ton lots, in buyers' bags, nominal, according to m.p.: £19-£30; hot pressed, bulk, ex-works, £40; refined crystals, d/d min. 4-ton lots, £65-£66.
Pitch. Medium, soft, home trade, f.o.r. suppliers' works, £10 10s; export trade, f.o.b. suppliers' port, about £12.
Pyridine. 90/160, per gal., 15s-17s 6d.
Toluol. Pure, per gal., 5s 2d; 90's, d/d, 2,000 gal. in bulk, per gal., 4s 11d.
MANCHESTER: Pure, naked, per gal., 5s 6d.
Xylole. According to grade, in 1,000-gal. lots, d/d London area in bulk, per gal., 5s 10d-6s 1d.

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(Prices Nominal)

***m*-Cresol** 98/100%. 10 cwt. lots d/d, per lb., 4s 9d.
***o*-Cresol** 30/31°C. D/d, per lb., 1s.
***p*-Cresol** 34/35°C. 10 cwt. lots d/d, per lb. 5s.
Dichloraniline. Per lb., 4s 6d.
Dinitrobenzene. 88/99°C., per lb., 2s 1d.
Dinitrotoluene. Drums extra. SP 15°C., per lb., 2s 1½d; SP 26°C., per lb., 1s 5d; SP 33°C., per lb., 1s 2½d; SP 66/68°C., per lb., 2s 1d.
***p*-Nitraniline.** Per lb., 5s 1d.
Nitrobenzene. Spot, 90 gal. drums (drums extra), 1-ton lots d/d, per lb. 10d.
Nitronaphthalene. Per lb., 2s 5½d.
***o*-Toluidine.** 8-10 cwt. drums (drums extra), per lb., 1s 11d.
***p*-Toluidine.** In casks, per lb., 6s 1d.
Dimethylaniline. Drums extra, c.p., per lb., 3s 5d.

High Plastics Sales in First Quarter 1959

SALES of plastics materials in the first quarter of this year were only slightly below the record level reached in the fourth quarter of 1958 and at 112,300 tons were some 9% higher than in the corresponding period of 1958. Stocks of plastics materials increased by almost 2,800 tons during the quarter, indicating that production was at the highest level so far recorded.

Sales of thermosetting materials at 44,700 tons were nearly 3% higher than the year before. Sales of thermoplastics at 67,600 tons were almost 14% higher in this quarter. By far the largest single increase was in sales of polythene. The increase in stocks of plastics materials was concentrated almost entirely in the thermoplastic field.

SALES IN THOUSANDS OF TONS

	1958	Jan.-March 1958	Jan.-March, 1959
Thermosetting Materials:			
Alkyds	44.7	11.1	11.5
Aminoplastics	49.9	13.2	12.6
Phenolics and cresylics	65.4	16.6	17.3
Polyesters	4.7	1.1	1.5
Other (*a*)	6.3	1.5	1.8
Total Thermosetting	171.0	43.5	44.7
Thermoplastic Materials:			
Cellulose plastics	11.6	3.5	2.6
Polyvinyl chloride (*b*)	73.3	18.4	20.2
Polystyrene	33.2	8.3	8.5
Other (*c*)	122.3	29.1	36.3
Total Thermoplastic	240.4	59.3	67.6
Total, All Plastics Materials	411.4	102.8	112.3
Stocks at end of period			
Thermosetting materials	16.2	16.5	16.7
Thermoplastic materials	38.4	32.7	40.8

(*a*) Including epoxide resins and casein plastics.
(*b*) Excluding sales of resins (*i.e.*, polymers sold as such).
(*c*) Including acrylics, polyamides, polytetrafluorethylene, polyethylene, polyvinyl chloride resins (*i.e.*, polymers sold as such), polyvinyl acetate.

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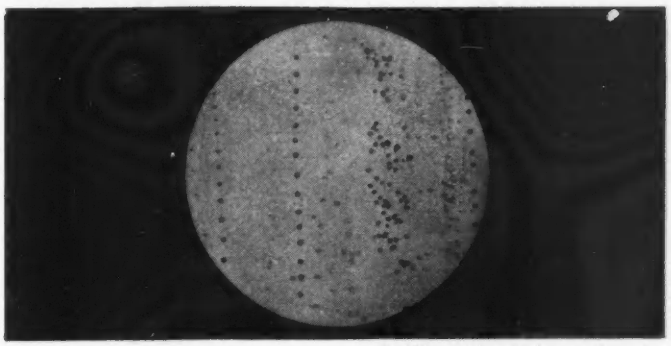

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 2 September

Silicone elastomers. Union Carbide Corp. **819 245**

Production of bicyclo heterocyclic phosphorus compounds. Union Carbide Corp. **819 424**

Process for preparation of terephthalic acid or its salts or derivatives. Beeston, A. W. (Henkel & Cie. G.m.b.H.). **819 281**

Organic aluminium sulphinates. Monsanto Chemical Co. **819 181**

Hydrogen peroxide. Laporte Chemicals Ltd. [Cognate application 4101.] **819 434**

Preparation of sulphomorpholides. American Cyanamid Co. **819 379**

Aromatic olefin polymerisation process. Esso Research & Engineering Co. **819 451**

Production of polycondensation products containing sulphur. Farbenfabriken Bayer A.G. **819 384**

Purifying isoprene by distillation. Gulf Research & Development Co. **819 188**

Modified polymer. Polymer Corp. Ltd. **819 293**

Emulsion polymerisation. Sandoz Ltd. **819 399**

Processes for polymerisation of 3, 3-disubstituted oxetane. Hercules Powder Co. **819 407**

Recovering terephthalic acid from aqueous solutions of dialkali metal terephthalate. Henkel & Cie. G.m.b.H. **819 282**

Production of vinyl esters. Chemische Werke Huls A.G. [Addition to 808 828.] **819 449**

Chlorinated and brominated polycyclic hydrocarbons, their preparation, and insecticidal compositions containing them. Shell Research Ltd. **819 240**

Open to public inspection 9 September

Process for production of polyethylenes and catalysts therefor. Ziegler, K. **819 867**

Method of and apparatus for manufacturing sulphuric acid by the contact process. Entreprise Rene et Jene Moritz. **819 786**

Manufacture of polyethylene-terephthalate capable of being spun. Farbwerke Hoechst A.G. **819 721**

Method of increasing the solvent-resistance of polyethylene. General Electric Co. [Addition to 773 529.] **819 810**

Cyanuric acid and preparation thereof. American Cyanamid Co. **819 730**

Processes for vulcanising natural and synthetic rubber latices. Hercules Powder Co. **819 669**

Ammonium nitrate and compositions containing it. Imperial Chemical Industries Ltd. **819 673**

Carbon black process. Cabot Inc., G. L. **819 823**

High polymers. Soc. Rhodiaceta. **819 679**

Fireproof unsaturated polyester resins. Solvay & Cie. **819 684**

Sulphide derivatives. Beecham Research Laboratories Ltd. [Addition to 810 389.] **819 688**

Halogenated synthetic polymers. Phillips Petroleum Co. **819 702**

Catalyst. Goodyear Tire & Rubber Co. **819 610**

Siloxane rubber tyre. Midland Silicones Ltd. **819 844**

Substituted urea herbicides. Farbenfabriken Bayer A.G. **819 853**

Open to public inspection 16 September

Process for the polymerisation of ethylene. Ziegler, K. **820 263**

Extraction of by-products from industrial gases. Mull, W., and Wildhagen, C. **820 206**

Catalytic hydrogenation treatment of hydrocarbons. Coal Tar Research Assoc. **820 164**

Rubber compositions and in antioxidants therefor. Goodrich Co., B. F. **820 170**

Cure of polyurethanes. United States Rubber Co. **820 004 820 005**

Multi-filament yarns based on substantially linear polyethylene and their production. Soc. Rhodiaceta. **820 191**

Process of producing pure silicon. Allied Chemical Corp. **820 192**

Production of highly concentrated hydrogen chloride and hydrogen bromide. Knapsack-Griesheim A.G. **820 093**

Purification of oxygen. Welsbach Corp. **820 143**

Process for production of gases containing methane from hydrocarbons. Gas Council. **820 257**

Process for the manufacture of porous or homogeneous polyurethane plastics. Farbenfabriken Bayer A.G. [Divided out of 820 265.] **820 266**

Catalysts for the polymerisation of ethylene. Ziegler, K. **820 264**

Open to public inspection 23 September

Polymers from propylene. [Addition to 734 501.] Standard Oil Co. **820 727**

Rubbery polymer-antioxidant. Goodyear Tire & Rubber Co. **820 486**

Methods of and apparatus for detecting the presence of carbon dioxide in a gas, for example, in air. Drager, O. H. **820 567**

Low-pressure polymerisation of olefins and catalysts suitable therefor. Petrochemicals Ltd. **820 450**

Open to public inspection 7 October

Unsaturated phosphenitrilic ester-polyhalohydrocarbon adducts. Albright & Wilson Ltd. **821 505**

Polymeric compositions containing nitrilo-methylol phosphorus polymers and bromine. Albright & Wilson Ltd. **821 503**

Methods of and apparatus for indirect heat exchange between two fluid media. De Danske Mejeriers Maskinfabrik A.M.b.A. **821 430**

Compositions for destroying and/or inhibiting weed growth. Heyden Newport Chemical Corp. **821 533**

Process for preparing substituted chloramines and substituted hydrazines. Grace & Co., W. R. **821 258**

Polyurethane foams and method of making same. General Tire & Rubber Co. **821 342**

Absorption, stripping, distillation and like columns. Metal Propellors Ltd. [Addition to 742 284.] **821 343**

Preparation of a tetracycline-urea compound. American Cyanamid Co. **821 309**

Recovery of tetracycline from an acidified fermentation mash. American Cyanamid Co. **821 310**

Concentrating aqueous glycols by distillation. Carrier Engineering Co. Ltd. **821 351**

Polymerisation processes. Imperial Chemical Industries Ltd. **821 353**

Stabilisation of liquid sulphur trioxide. Olin Mathieson Chemical Corp. **821 355**

Production of carbon black. Cabot Inc., G. L. [Addition to 819 283.] **821 573**

Silicone elastomers and processes for curing same. Union Carbide Corp. **821 477**

Method of preparing alkali metal hypophosphites. Fonte Electrique S.A. **821 488**

Production of polyoxyalkylene compounds. Petrochemicals Ltd. **821 203**

Reforming naphtha. Esso Research & Engineering Co. Ltd. **821 210**

Process for nitrosation. Du Pont de Nemours & Co., E. I. **821 400**

Extended-life fluorination catalyst. Dow Chemical Co. **821 211**

Recovery of high purity hydrocarbons. Esso Research & Engineering Co. **821 402**

Recovery of a solvent from a mixture of the solvent with one or more hydrocarbons. Bataafsche Petroleum Maatschappij N.V., De. **821 498**

Production of toluylene diamines. Farbenfabriken Bayer A.G. [Addition to 768 111.] **821 220**

Open to public inspection 14 October

Continuous process for the manufacture of titanium metal. Spence & Sons Ltd., P. **821 817**

Dithiophosphoric acids and derivatives thereof and process for their manufacture. Deutsche Erdöl A.G. **821 937**

Method of polymerising olefins to linear polymers of high molecular weight. Montecatini Soc. Generale per L'Industria Mineraria E Chimica, and Ziegler, K. [Addition to 810 023.] **821 838**

Germicidal polyamino ether alcohols. Givaudan & Cie. S.A., L. **821 622**

Hydroquinone compound and process for making same. Ciba Ltd. **821 924**

Process and a fuel cell for the production of electrical energy from liquid fuels. Ruhrchemie A.G., and Steinkohlen Elektrizitaet A.G. **821 688**

Production of an antibiotic designated novobiocin. Merck & Co. Inc. **821 819**

Isolation and purification of the antibiotic novobiocin. Merck & Co. Inc. [Addition to 821 819]. **821 820**

Oxygenated steroids and process for their manufacture. Reichstein, T. **821 777**

Hydrogenated resin and a process for preparing it. Esso Research & Engineering Co. **821 698**

Production of unsaturated hydrocarbons. Union Carbide Corp. **821 456**

Process for effecting sublimation in a fluidised bed sublimer. Farbenfabriken Bayer A.G. **821 643**

Process for obtaining uranium tetrafluoride, more especially in a nuclear-pure form. Deutsche Gold- und Silberscheideanstalt Vorm Roessler. **821 957**

Hydrocarbon resins. Esso Research & Engineering Co. **821 928**

Purifying acrylonitrile by distillation. American Cyanamid Co. **821 958**

Emulsion polymerisation process and product thereof. Shawinigan Chemicals Ltd. **821 961**

Nitro dyestuffs. Imperial Chemical Industries Ltd. **821 963**

Preservation of latex. British Rubber Producers' Research Assoc. (Sekaran, K. C.) **821 872**

Mixed anhydrides. Imperial Chemical Industries Ltd. **821 964**

Isolation process. Imperial Chemical Industries Ltd. **821 733**

Polymeric material. Burke, O. W. **821 971**

Epoxide resins. Devoe & Raynolds Co. Inc. **821 972**

Extraction of thorium from aqueous solution. U.K. Atomic Energy Authority. **821 973**

Production of monohydroxy polyethers of polyhydric alcohols. Farbenfabriken Bayer A.G. **821 977**

Curing synthetic drying oils and polyisocyanates. Esso Research & Engineering Co. **821 979**

Process for the production of acrylic acid. Union Chimique Belge S.A. **821 980**

Manufacture of amides. Imperial Chemical Industries Ltd. **821 982**

Compositions containing boron compounds. Standard Oil Co. **821 986**

Preparing sustained release particles and product of the method. Smith Kline & French Laboratories. **821 790**

Unsaturated polyester resin compositions. Farbenfabriken Bayer A.G. **821 988**

Preparing trichloroacetic acid. Knapsack-Griesheim A.G. **821 913**

Recovery of alkali metal content and terephthalic acid from aqueous solutions of dialkali metal terephthalates. Henkel & Cie G.m.b.H. **821 991**

Purification of perchloroethylene. Columbia-Southern Chemical Corp. **821 996**

Solvent extraction process. Universal Oil Products Co. **821 998**

Catalytic oxidation of olefins. Standard Oil Co. **821 999**

AMENDED SPECIFICATIONS

On Sale 22 July

Hard metal carbide products. Nussbaum, L. **774 817**

Metal soap-salt complexes and lubricating grease compositions containing them. Esso Research & Engineering Co. **778 567**

On Sale 14 October

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